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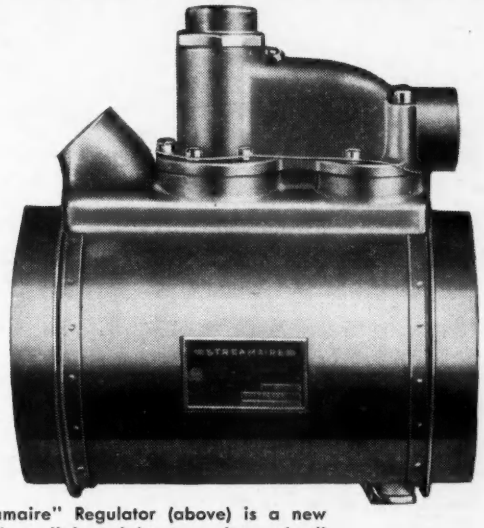

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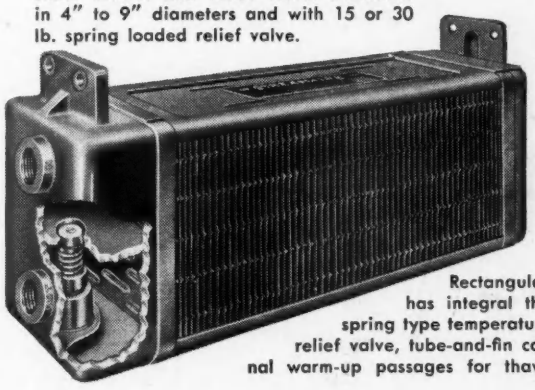

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MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE *Lo-swing* PEOPLE"** SENECA FALLS, NEW YOR

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meets exacting demands on SHOCK ABSORBER PART JOB

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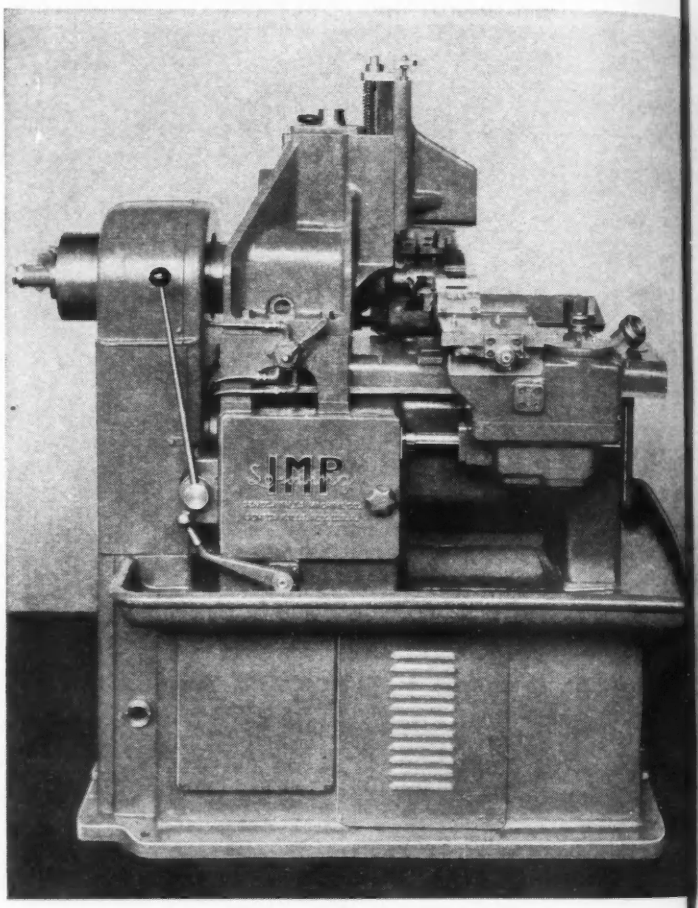
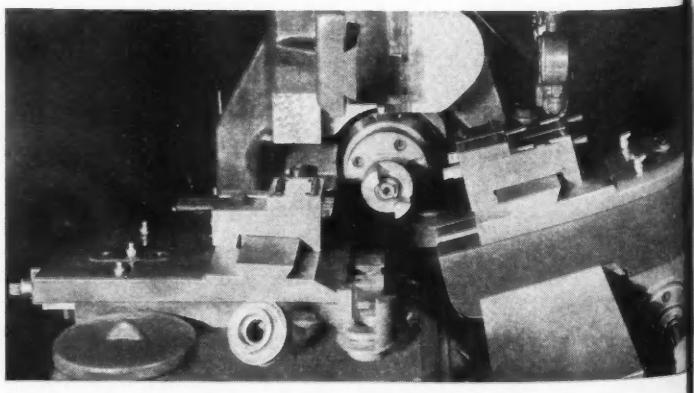
As mentioned above, Cemented Carbide Tools were used to maintain high productive efficiency on these lathes.



As shown in the illustrations, the Front Carriage carries three tools which turn three diameters on the OD; a single tool on the Third Arm finishes a step on the part to very accurate limits; the Back Attachment, equipped with two tools, faces both ends of the piece. The work is held by an air-operated Draw Bar.



LATHE NEWS from SENECA FALL

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

Volume 95, No. 5
September 1, 1946

Industry Needs the Census

By Paul Wooton

BUSINESS and industry need census figures as never before. Basic statistical data on production and distribution of goods are just as important as are comparable figures covering agricultural products, for which generous provision always is made. Legislation that will insure thorough-going censuses of manufacturing and distribution should be high on the "must" list of the new Congress.

Transformation in manufacturing and in distribution has been great as a result of the war. There have been no basic figures since 1939. In compiling current data all statistical services use the fundamental census figures as bench marks.

Since 1939 billions of dollars have been spent on new industrial plants and equipment. During the war more than half of the country's industrial capacity was turning out war goods. Now most of this capacity is back in peacetime production. Between 1942 and 1946 it is known that many small businesses suspended because of difficulties, among others, in securing manpower and materials. With the return of our fighting forces there has been a great upsurge in the establishment of small businesses. So as to meet the situation intelligently the actual facts must be known. The veteran would be one of the beneficiaries.

Just why a Congress that blithely voted nearly $3,000,000,000 for terminal pay, about which there was much question, should "economize" by striking out $17,000,000 for Census figures is hard to explain, but nothing is gained by recriminations. Congress has adjourned. The thing to do now is to make sure that an appropriation will be approved as early as possible in the new Congress.

There is an educational job to do. Not all citizens and not all businessmen realize the importance of precise knowledge. It is essential to illuminate the field in which business operates. Otherwise it flounders around in the dark and the interests of everyone suffer.

If data are not available as to production there is no way of knowing its relationship to demand or the kind and quantities of raw materials needed. Trends in the fields of production, of distribution and of the service industries must be definitely outlined so businessmen know what to do. This will be more important as some of the shortages are relieved and supply and demand come closer together. Facts are needed if waste is to be avoided and efficiency promoted. Collection of statistics in a country with a complex economy can be done only by a central agency with legal authority to get the information. It is a Federal activity that supports and strengthens private enterprise.

Business needs to know where people reside before marketing can be done intelligently. During the war nearly 30,000,000 persons changed their residences. They left their old homes to fit into the changed pattern of production brought about by the war. No migration in history affected such a large number of

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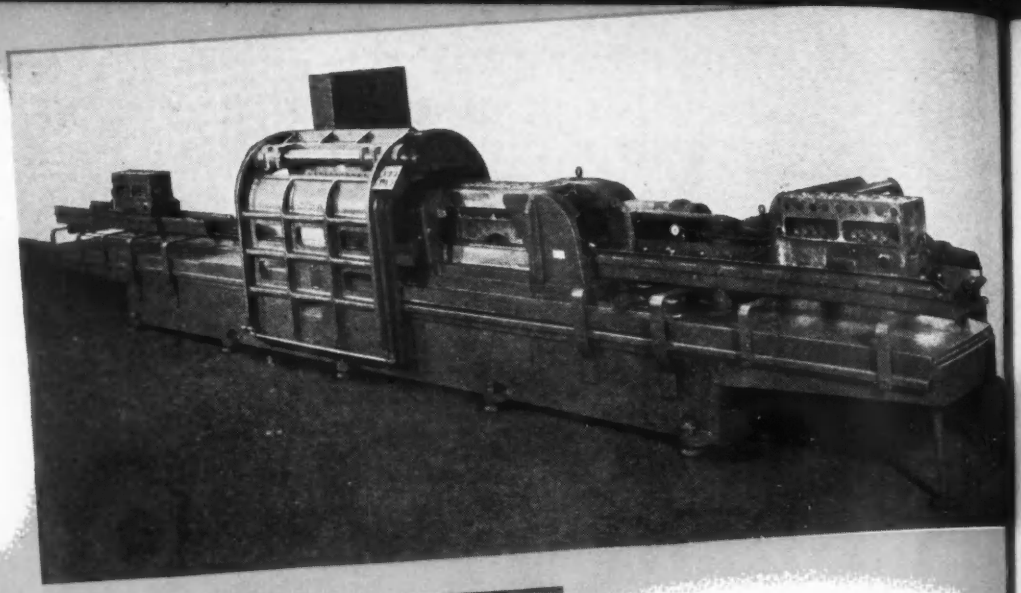
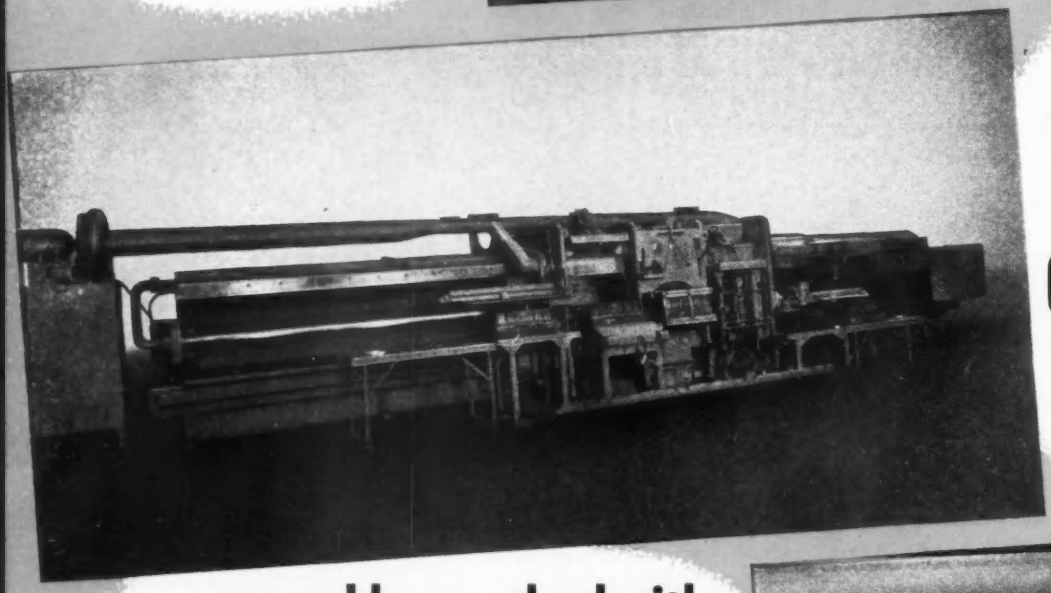
CINCINNATI

TIGHTER GASKET JOINTS and . . .





. . . BROACHING 5 SURFACES on 60 CYLINDER BLOCKS per hour . . .

. . . are problems solved with CINCINNATI HORIZONTAL HYDRO-BROACH MACHINES

It's a foregone conclusion that parts requiring many machining operations will be nicked and scratched on the surface first machined. This happens to cylinder head blocks, so one automobile manufacturer takes a light finishing cut on the cylinder head gasket surface just before assembly (illustration at top). Perfect flatness and a smooth surface are restored. Production, 112 blocks per hour. ¶ Contrasting this meticulous operation, the machine in the second illustration broaches five surfaces on cylinder blocks . . . roughs the half-bore and roughs and finishes the bottom while the ram travels from right to left; then roughs and finishes the top, push rod, and distributor pad surfaces while the ram travels from left to right. Production, 60 blocks per hour. ¶ Both are CINCINNATI Horizontal Hydro-Broach Machines, tooled up by Cincinnati Application Engineers. These illustrations give you an idea of the variety of Horizontal Broaching Machines built by Cincinnati for accurately finishing external surfaces on large parts. Bring your machining problems to Cincinnati for an economical cost cutting solution.

Close-up of work and broach inserts

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New OPA Headaches for Car Makers

By Leonard Westrate

WHETHER or not the automotive industry is any better off under the extended and amended OPA law as finally approved by the President than it was under previous OPA regulations is an open question. It still is too early to tell whether the objectives of Congress will be fully translated into actualities under the administration of the bill, but there are some obvious implications arising from both the bill itself and the feverish maneuvering that surrounded its enactment and passage.

For one thing, the cost of living items that bite deeply into the income of labor are much less stringently controlled than are manufactured goods generally. With the exception of rents, essentials such as clothes, food, shoes, gasoline, and fuel already have increased in price. All of which spells potential trouble for the manufacturer in the form of renewed wage increase demands and possible strikes. Already, Chrysler locals have petitioned the UAW-CIO executive board to seek a "cost-of-living" bonus, and rumblings are being heard in other plants to reopen wage contracts. The rise in prices for cost of living goods in recent weeks is ammunition for union leaders and they can be counted on to exploit it to the full. At the moment, it appears that wage strikes in the automobile industry will be put off until at least after the elections this fall, but if living costs continue to mount, the leadership may not be able to hold its members in check.

Another consideration is that the Crawford amendment, restoring prewar discounts to dealers, is of no help to the manufacturer but does pose a serious problem by raising car prices, already considered too high, to levels which make any further increase needed by the manufacturer to cover increased costs a particularly tough objective. Not only does it add to the difficulty of tacking on a legitimate increase of their own, but it also is bound to cut heavily into the potential market and to hasten the day when a buyers market will prevail.

When it comes down to the actual mechanics of getting approval from OPA on manufacturers prices under the new law, the situation for the automobile maker gets complicated. There has been a great deal said about specific profit margins and recovery of increased costs as being mandatory under the law. However, careful reading dispels the idea that increased prices to achieve these objectives will come automatically. Actually, they must be granted only after application has been made and comprehensive information has been supplied to OPA.

The actual wording of the section dealing with general price levels is interesting. Paragraph (b) of Sec. 6 states: . . . "no maximum prices shall be established or maintained for any product of a producing, manufacturing, or processing industry . . . which do not return on the average to the industry not less than the average dollar price of such product during the base period, plus the average increase in cost of producing, manufacturing, or processing the same accruing since the base period, but the maximum prices for a product shall be deemed in compliance with this standard if such prices on the average are equal to the average total current cost of the product plus the industry's average over-all profit margin on sales in the base period." Other paragraphs of this section define the base period as the calendar year, 1940, or the fiscal year 1940 for companies keeping accounts on the fiscal year basis, and outline requirements that an industry advisory committee make application and submit price and cost evidence.

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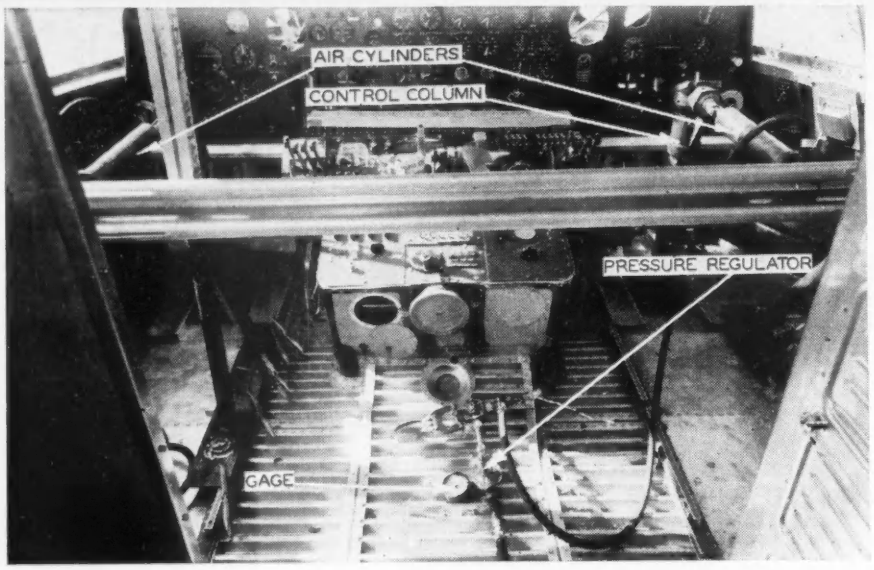

Fig. 1 — Setup for testing airplane controls, air cylinders are calibrated prior to test, load being measured in terms of air pressure and controlled by means of pressure regulator shown.

By C. R. Smith

Test Engineer
Consolidated Vultee Aircraft Corp.

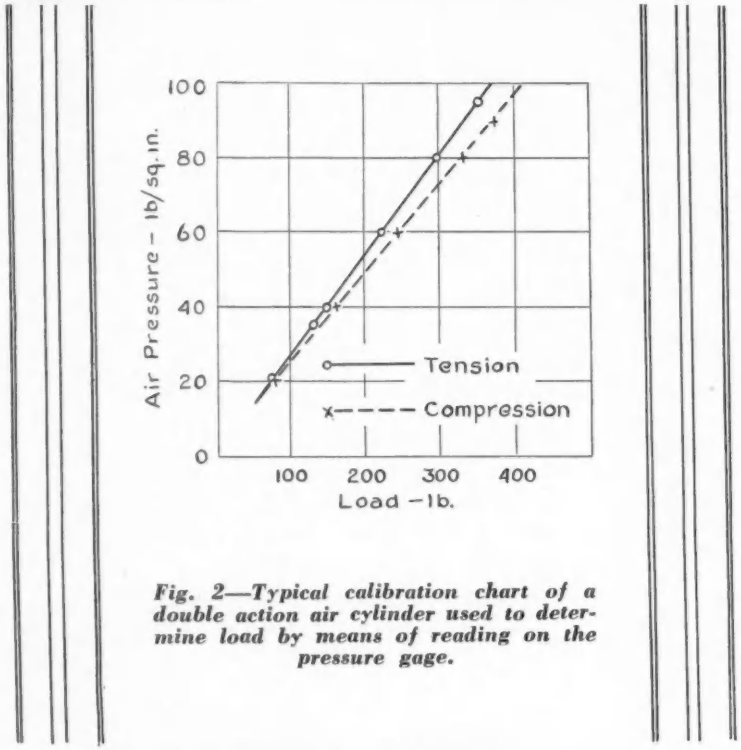

Fig. 2—Typical calibration chart of a double action air cylinder used to determine load by means of reading on the pressure gage.

HYDRAULIC loading has taken a prominent part in the testing of aircraft structures. However, there are many instances where air pressure would be more suitable than hydraulics. Especially is this true for small loads with large deformations, such as for proof loading a control system as shown in Fig. 1. Here, small air cylinders, having cross-sectional areas of approximately four sq in. each, are connected with line pressure through a four-way valve, pressure regulator, and gage. Having been calibrated prior to test, any load within the capacity of the apparatus can be applied at will by regulating the pressure to the proper gage reading.

Typical calibration graphs are given in Fig. 2. The data for these were obtained by testing the air cylinders in a Southwark-Emery hydraulic testing machine, load being applied with the cylinders and weighed by the testing machine.

Another simple setup, using air cylinders, is that for applying reverse loading on a rudder torque tube as shown in Fig. 3. Here the specimen is being subjected to torsion and bending loads as might be imposed by thunderstorm gusts on the vertical control surfaces. Since the test was of short duration and

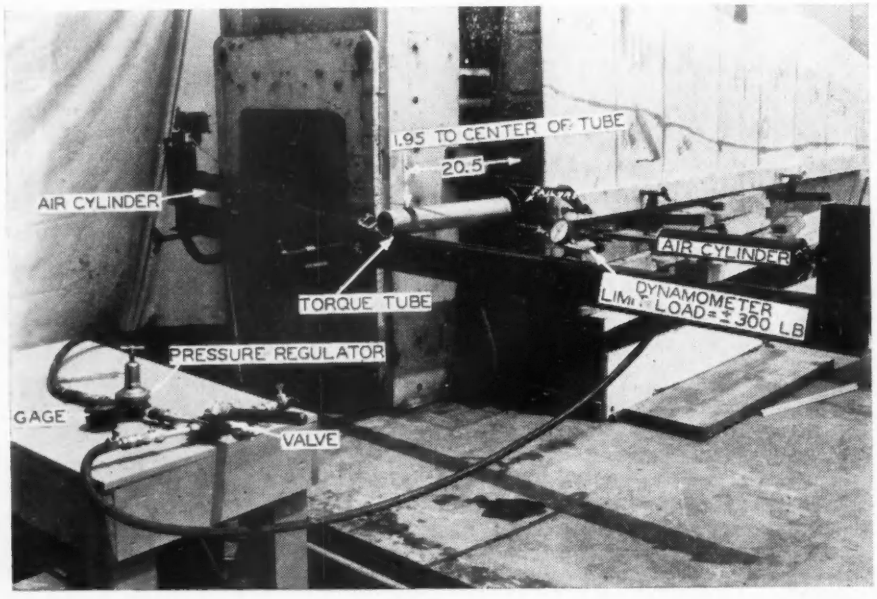

Fig. 3—Air cylinders used to apply reverse loading for endurance test.

Air Pressure for

Testing Aircraft Structures

required almost constant inspection, the air valve was controlled manually. However, for longer tests, a simple motor operated mechanical arrangement can be employed for automatic control.

Automatic control for hydraulically operated endurance tests has been accomplished by using a hydraulic windshield wiper inserted in the oil line as shown in Fig. 4. The one shown, manufactured by the Kearfott Engineering Co., Inc., normally operates at pressures of from 800 to 1500 psi, the differences in operating pressure being accomplished by changing the adjusting spring. Accordingly, desired peak test load can be acquired by supplying the proper spring constant, the corresponding peak pressure being built up before changing flow. As loading is independent of specimen deformation, this feature is especially desirable for testing specimens whose rate of deflection may change with fatigue such as in the case of large composite splices or structures. The oil for the above is supplied by a motor driven hydraulic pump.

Whereas the hydraulic windshield wiper has been successfully operated at pressures far below the 800 psi design value by using relatively weaker springs for adjustment, operating at air pressures of below 100 psi has not been so successful in that the peak loads may vary 10 psi, which would amount to 10 per cent or more experimental error in the air pressure range of most factory air lines.

Sometimes a portable testing machine is desired for testing small appliances. The setup shown in Fig. 5 is an aircraft main landing gear retracting cylinder being used for proof testing a small assembly. If the pressure is regulated to conform with the desired load, hundreds of assemblies can be proof loaded in this manner without further adjustment, release of the

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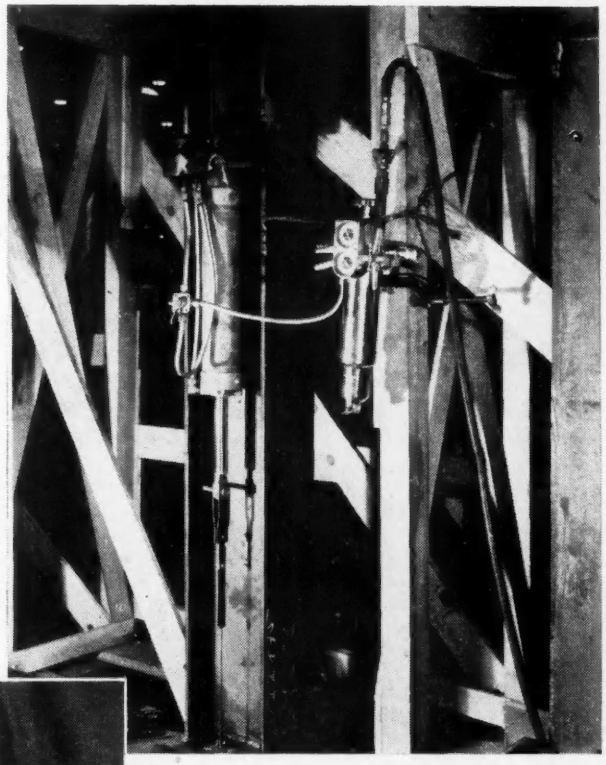


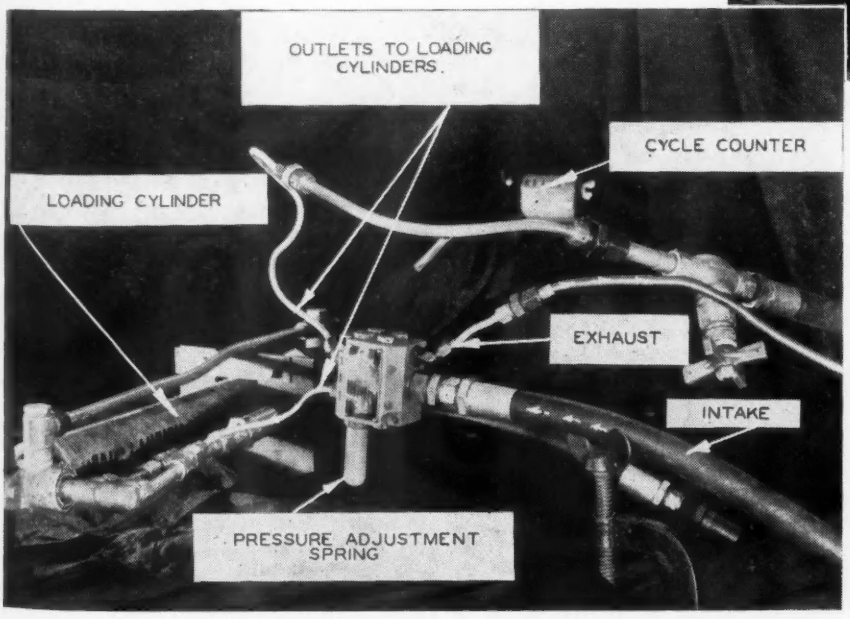


Fig. 5—(Above) Air loaded hydraulic cylinder being used as portable testing machine, a quick way of proof testing small assemblies.

Fig. 4—(Left) Setup using hydraulic windshield wiper for automatic load control.

Scania-Vabis 4½-ton truck equipped with front drive. This model was shown at the company's recent exhibition in Stockholm.

By

Hans G.

Tonndorf

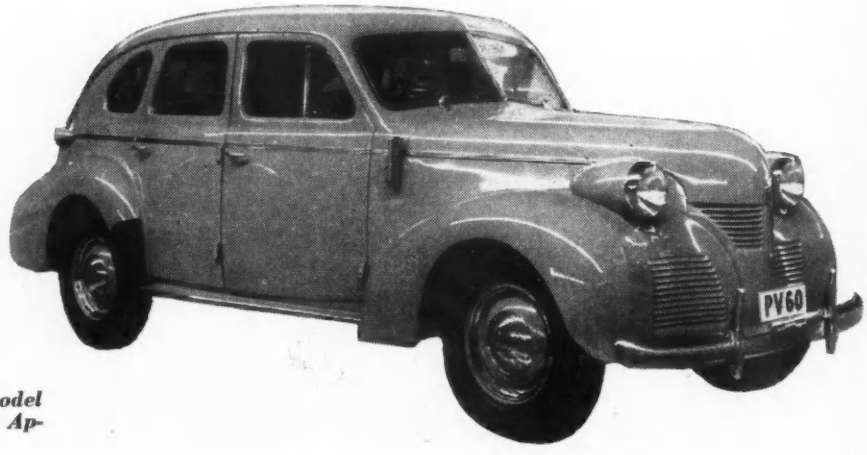
Automotive

SWEDEN'S automobile industry has long been a tailor-made industry manufacturing special vehicles for individual needs. It expanded to some extent during World War I but fell off again during the postwar years as a result of severe competition from the mass-producing industries of the United States and other countries. But in the end of the Twenties, the Swedish automobile industry entered a new era of progress which was closely related to the Volvo Co. From the very beginning, this organization was aiming at large-scale production. During the entire Thirties the industry advanced rapidly in regard to car performance, production efficiency and output of production. In 1936-37, it is claimed, the Swedish industry built trucks having the performance of similar American trucks and in 1939 attained the same goal with respect to passenger cars.

When the war broke out the Volvo Co. was engaged in a substantial expansion program, comprising 9000 automobiles. However, as a result of the outbreak of war production stayed that year at 7000. Scania-Vabis, the other and older motor company of the country manufactured 350 motor vehicles that year, chiefly busses and trucks.

During the last few prewar years, motorism developed rapidly in Sweden. There were 160,000 automobiles registered in 1935 and 250,000 in 1939, making Sweden the most motorized country in Europe next to Great Britain, France and Denmark. There were 170,000 persons directly engaged in the automobile trades—in motor-traffic, automobile and oil distribution, road-building, repair shops and in the manufacturing and assembling of automobiles.

This upward trend was, of course, interrupted by the war. Faced with an almost complete shutting off



PV 60 five-passenger car, a new model announced by the Volvo company. Approximate price is $1760.

Sweden's largest bus built by Hagglund and Soner. It is 45 ft. long, accommodates 86 passengers and its gross weight is 11 tons. The engine is an eight-cylinder 180-hp Diesel. Among its features are a double loud speaker system and fresh air conditioning. (European photo)

Manufacturing in Sweden

of oil and automobile imports the total of registered automobiles had to be reduced to one-third of prewar. As will be seen from the following table the reduction was especially severe in regard to passenger cars.

	Passenger Cars	Buses	Trucks	Total
1939	180,700	5,100	63,000	248,500
1945	40,000	3,900	38,200	82,100

Practically all the remaining vehicles were converted to use producer-gas. The transition to this fuel required substantial investments in the acquisition of producer-gas units. The manufacture of producers as well as the distribution of fuel kept many in business who had been making their living in the automotive and related trades. Volvo alone manufactured about 15,000 producer-gas units but there was hardly a work shop with more than 10 employes which did not take up the production of this item.

For the two automotive manufacturers the war meant rather an expansion than a contraction of their activities. With their excellent production facilities they were predestined to play a great part in the nation's rearmament program. Thus Volvo and Scania-Vabis turned out a great many motor vehicles for the armed forces, among them armored cars, 22-ton tanks, artillery trucks and other vehicles.

Equipped with abundant funds the industry greatly expanded its experimental and production facilities. Thus the Volvo Co. tripled its staff of engineers during the war period. There is no doubt that dealing with new tasks and problems greatly increased the industry's know-how, its engineering and production capabilities.

In a way working for the Army, to use an expression of the president of the Volvo Co., meant the transition of activities "from the highway to the open field." One of the outcomes of this venture is a new Volvo truck with four-wheel drive and eight speeds which will prove particularly useful for lumber transports in the forests.

Although largely engaged in the production of military vehicles the contacts with the civilian market were never entirely disrupted. Thus even during the war years Volvo made between 3000 and 4000 automobiles for civilian purposes, chiefly trucks. This company also entered the tractor field with a small tractor especially designed for Swedish agriculture. During the immediate postwar years 2000 tractors of this type will be manufactured yearly.

To cope with the enormously increased wartime demand Volvo greatly expanded its plants in Gothenburg. But this was not enough. Volvo purchased four other companies in the mechanical field, among them the Aero-Engine Co. at Trollhättan. Thus Volvo, formerly a single corporation, emerged from the war as a combination of five companies. Financially, this ex-

pansion is reflected in an increase of the share capital of the Volvo Co. from $4.5 million to $8.5 million.

It might be asked how an automotive industry in a small country and with a limited market could compete on equal terms with the huge mass-producing organizations of the United States. The answer is that the Swedish automotive industry or, at least, the Volvo Co., has adopted the principle of mass-production, although transformed according to the special requirements of a small, but highly industralized country.

Mass-production methods could, of course, not be accomplished within the framework of a comparatively small organization. It has been possible only by making a large portion of Sweden's manufacturing industry participate in the large-scale production of automobiles.

Thus the Volvo Co. at Gothenburg is frequently referred to as "Little Volvo." It is, in fact, merely an assembly plant. "Big Volvo" is the combination of, at least, 80 independent organizations, spread all over the country, which are manufacturing all the parts finally put together at the Volvo plant at Gothenburg.

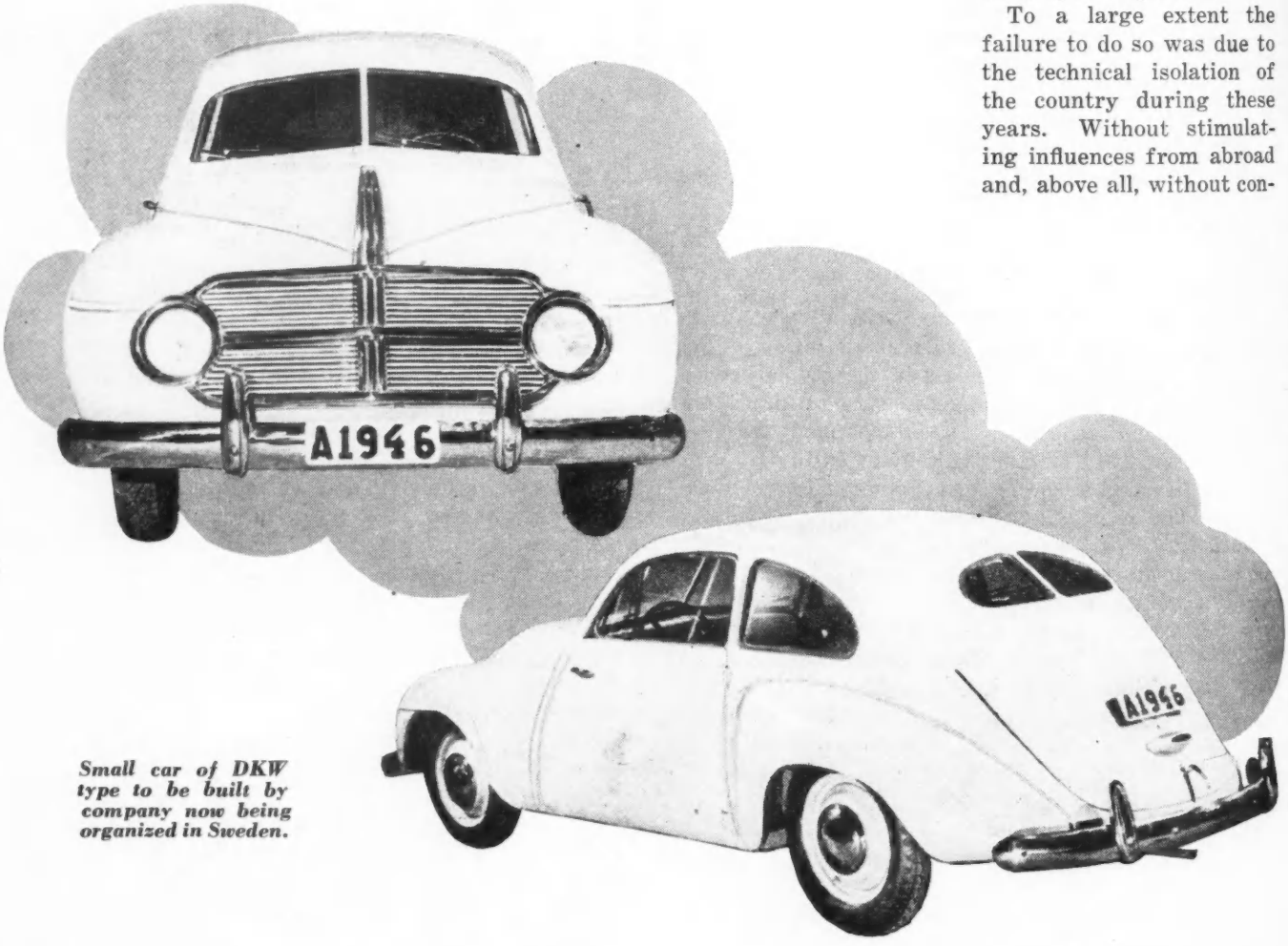
The Volvo Co. provides all the blueprints and distributes the production of the different parts and accessories to sub-contractors in accordance with their equipment and other facilities. Through this system of sub-contracting there is obtained effective large-scale manufacture of the individual parts which would be impossible within the scope of a middle-sized automotive organization. From this it becomes clear that everything that pertains to the distribution of work and purchases in general is a vital part of the company's activity.

Although Volvo was determined to have as many parts as possible manufactured domestically the company's policy was not to make an "All-Swedish" car at any price. In a great many cases it was found that it is cheaper to import certain parts than to get them from domestic manufacturers. Thus Volvo used to import about 15 per cent of its purchases from the United States, Great Britain and other sources.

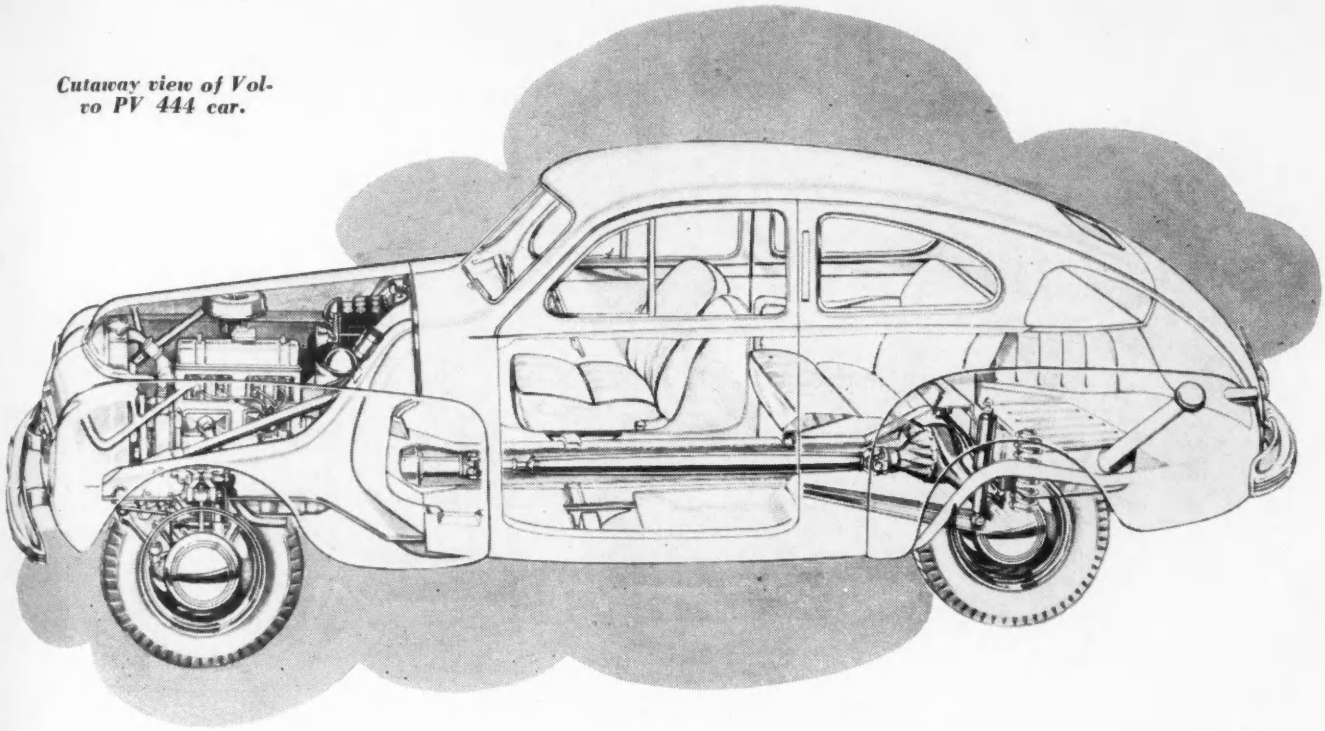
With the disruption of Sweden's westbound trade Volvo had to get along without the heretofore imported parts which now had to be manufactured domestically. This has not so much affected the quality as the cost and price of the cars. With the end of the war Volvo has again, in accordance with its prewar policy, turned to foreign sources for the supply of a great many parts and accessories.

During the war years the Volvo Co. encountered certain difficulties with its sub-contracting scheme. For one thing, most of the suppliers were overburdened with orders for the Army and for private industry. Competition was no longer effective and there were few opportunities to shift orders from one manufacturer to another as has been frequently done in prewar years. The suppliers generally showed little inclination to reduce production costs and prices of their specific products.

To a large extent the failure to do so was due to the technical isolation of the country during these years. Without stimulating influences from abroad and, above all, without con-



Small car of DKW type to be built by company now being organized in Sweden.



Cutaway view of Volvo PV 444 car.

tacts with the machine-tool manufacturers of the United States, technical and industrial progress was, undoubtedly, largely slowed up during the war.

It is hardly surprising that automobiles have been no exception from the general upward trend of costs and prices. As a result of increased costs of fuel, materials and wages and the absence of counteracting labor-saving and cost-reducing devices the costs of purchased parts, accessories and other materials for the automotive industry jumped by about 60 per cent between 1939 and 1945, not considering the increased costs of formerly imported but now domestically manufactured items. Consequently the prices of Swedish cars and trucks appear to have risen more than those made in the United States. On the other hand, with the cost of fuel and certain other cost items likely to decline and with the installation of new equipment there is undoubtedly good reason to expect a forthcoming reduction of over-all production costs. Furthermore, the severe competition of the American automobile manufacturers both in the domestic as well as foreign markets will undoubtedly force the prices of Swedish cars down.

The Volvo Co. is now about to undertake its large-scale postwar program. It will manufacture 20,000 motor vehicles, including 10,000 passenger cars, 8000 trucks and busses and 2000 tractors, per year.

The most notable feature of this program is undoubtedly the dominant position devoted to passenger cars which traditionally have played only a minor part in the production program. Of the 10,000 passenger cars, 8000 will be the type PV 444 which has had a great appeal to the Swedish public. It is a four-seater, four-cylinder 42-hp car selling for $1200 (PV 444 was described in March 1, 1945 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, page 28).

This program has been delayed as a result of the long-lasting strike in the Swedish metal industries, with the result that the 4-seater car production did not begin until this summer. In the meantime the production facilities at Gothenburg have been further enlarged, at the cost of $2 million. An automobile laboratory has been built and it is supposed to be largest in Europe.

Scania-Vabis has been making automobiles for more than 40 years. The emphasis of its production is still on trucks, busses and specially designed vehicles. Scania-Vabis has long been famous for the strength and durability of its automobiles.

As with Volvo, the war years were a period of expansion and innovations. At a cost of a million dollars the plant at Södertälje, near Stockholm, was rebuilt and a new factory measuring 8000 square meters was added. Furthermore, the entire plant was re-equipped with American machinery which arrived on April 9, 1940, the very same day Sweden was cut off from its overseas trade. Production facilities were further enlarged through the purchase of the nearby plants of the Swedish Machine Works (Svenska Maskinverken).

As a result of wartime expansion Scania-Vabis is now in the position of turning out a much greater number of civilian automobiles than prewar. Its postwar program calls for 2500 motor vehicles as against 350 in 1939.

Up to now, Sweden's automotive industry was comprised chiefly of Volvo and Scania-Vabis. Now there is likelihood that another automotive company will appear on the scene.

Prior to the war the Philipson Co. had been the importer of Chrysler and Dodge as well as of the German DKW. The American cars were assembled at Augustendal where the company has a port of its own for the handling of the parts shipped from the United States. During the war years the former as-

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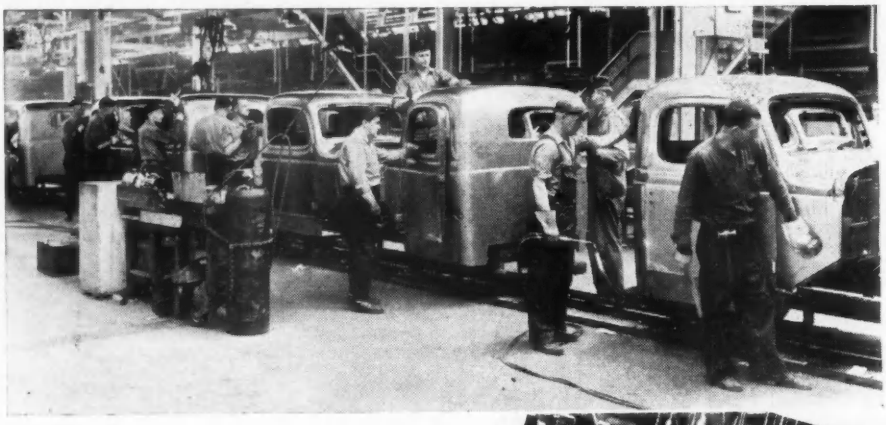
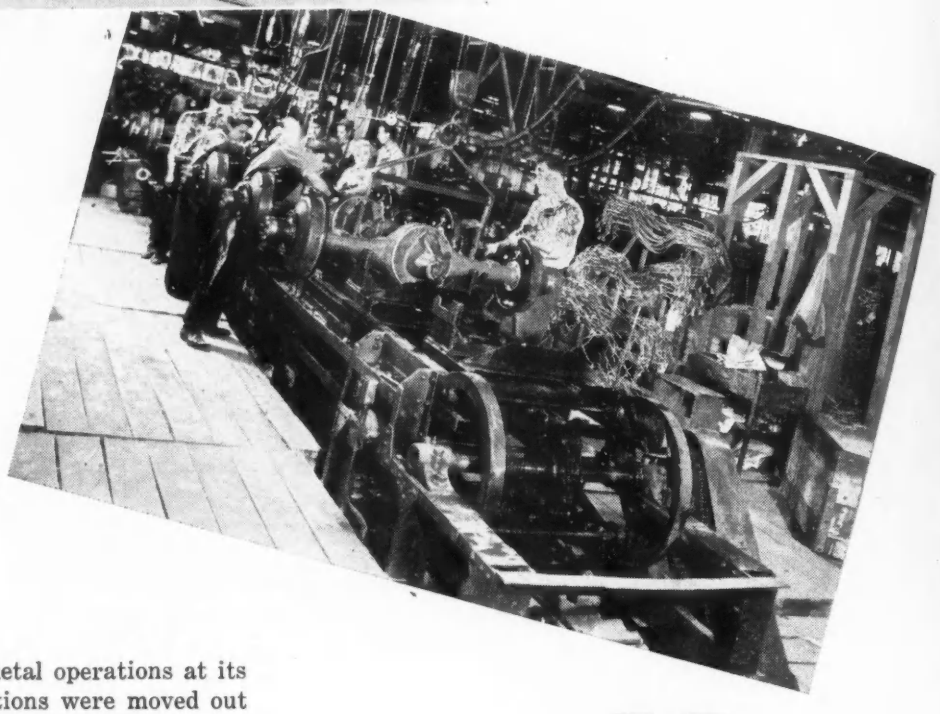


(Left) Part of the long line for finishing cabs in "white" in preparation for the paint shop overhead.

(Below) Rear axles are assembled on one of two mechanized assembly lines shown here.



Major

EMERGING from the war program with what is said to be the largest plant in the world devoted exclusively to motor truck manufacture, Dodge Division of Chrysler Corp. has greatly expanded its facilities and floor space and now boasts a total area exceeding 1,270,000 sq ft. The building addition recently placed in operation provided space for housing all body and sheet metal operations at its Detroit plant. When these functions were moved out of the assembly section the space thus released made it possible to expand primary assembly lines and to install a number of major sub-assembly lines which have been instrumental in increasing the overall productivity.

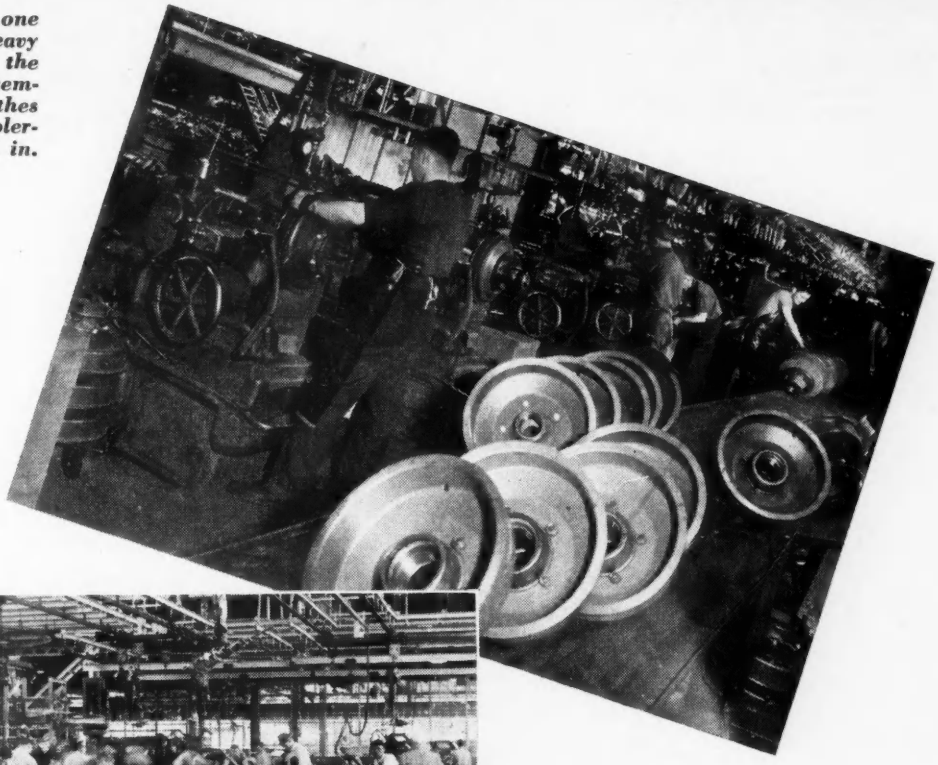
If you consider the enormous task involved in the normal production of several hundred motor trucks per day with the great variety of chassis and body types and options of extra and special equipment, you can better appreciate that the smooth and apparently effortless movement of vehicles on the assembly lines stems from skillful development of the stages of process, careful attention to sub-division of tasks at individual stations, and a smooth flow of materials and finished components. As will be described later the art of scheduling has been developed on a high plane so as to coordinate the functions from raw materials to the final vehicle off the line.

Raw materials and purchased parts are received on the loading dock along one side of the assembly building, coming in by freight cars and trucks. In keeping with the principle of smooth flow, the cars are spotted and parked at locations nearest to the point of usage so as to reduce hauling. A comprehensive system of overhead monorail conveyors, approximately four miles in length, carries parts and raw materials and stampings to the fabricating departments, to the paint shop, and finally to feed sub-assembly and final assembly lines. The system of floor conveyors for sub-assembly and final lines exceeds 2¼ miles in length.

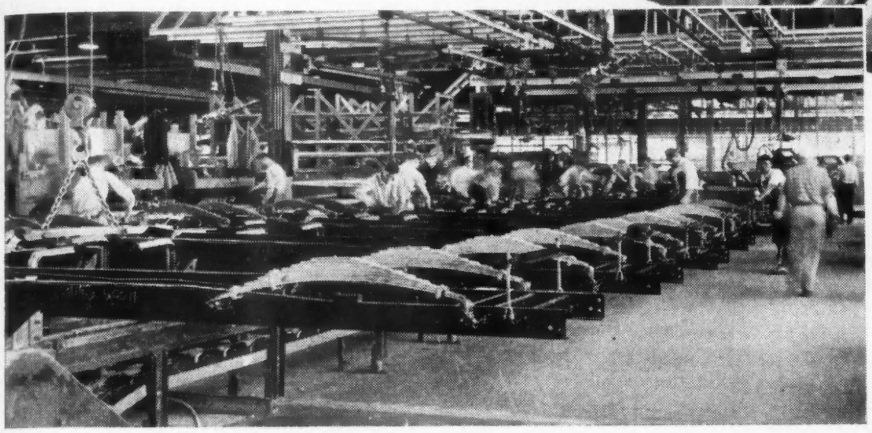
Although this plant has no facilities for metal cutting, its functions go beyond the original conception of an assembly operation. For here will be found metal finishing, the assembly of cabs and bodies, painting of all bodies, sheet metal, wheels, etc., assembly of front and rear axles, production of all cushions and trim, final outfitting of engine assemblies.

Mechanization has been carried out to its maximum. In addition to the conveyor systems mentioned above, Dodge has merry-go-round sub-assembly lines for front-end sheet metal, for fender finishing and for engines; wheel chutes for carrying wheel and tire assemblies from the assembly platforms to the final lines, overhead transfer cars for transporting bodies to the final lines, craneway for transporting engines to the final lines, and a variety of other equipment of this character. Too, there is a fleet of industrial trucks of every description for interdepartmental

(Right) Two machine lines — one for light, the other for heavy models—are in operation for the final truing of brake drums assembled to hubs. The Stub lathes shown here turn drums to a tolerance of plus or minus 0.0015 in.



(Below) View of heavy frame line showing preparation prior to final assembly. Note overhead mounted tools and craneway for the handling of frames



By Joseph Geschelin

Operations *and Scheduling of Huge* Dodge Truck Plant

hauling. In short, every facility has been provided to eliminate or relieve manual tasks, to reduce the manual effort on the part of workers.

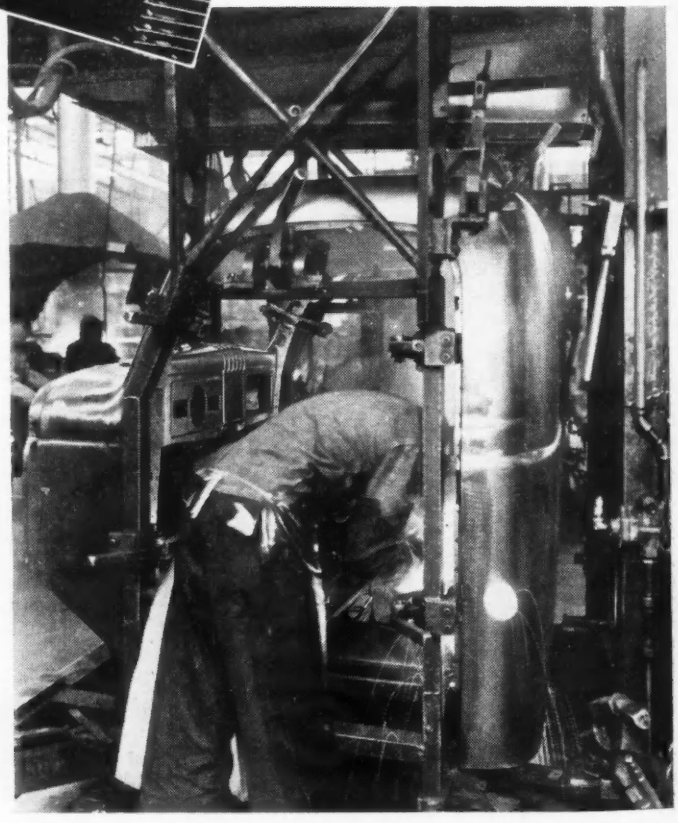
To visualize the stages of the process leading to final assembly, consider that the backbone of the operation consists of the two long final assembly lines—one for light models, the other for heavy duty models —each one served by sub-assembly stations or conveyor lines as close to the point of usage as is feasible. The assembly process begins with the building up of chassis frames on sub-assembly lines, particularly the addition of frame attachments and brackets while the frame is up-side-down. Powerful hydraulic squeezers are used for the cold-riveting of frame attachments, producing fastenings of high quality and without any of the noise and fury usually associated with such operations. Frames then are transferred to the main lines, still up-side-down, to facilitate the assembly of under-frame units such as wiring and tubing, springs, axles, propeller shafts. Then the chassis are turned

This is the 121st in the series of monthly production features

(Right) Chassis moving on the final assembly line reach the body drop shown at this point. Bodies are transported from the bank by means of the overhead car.

(Left) Another view of one of the two final assembly lines—nearing the end of the line.

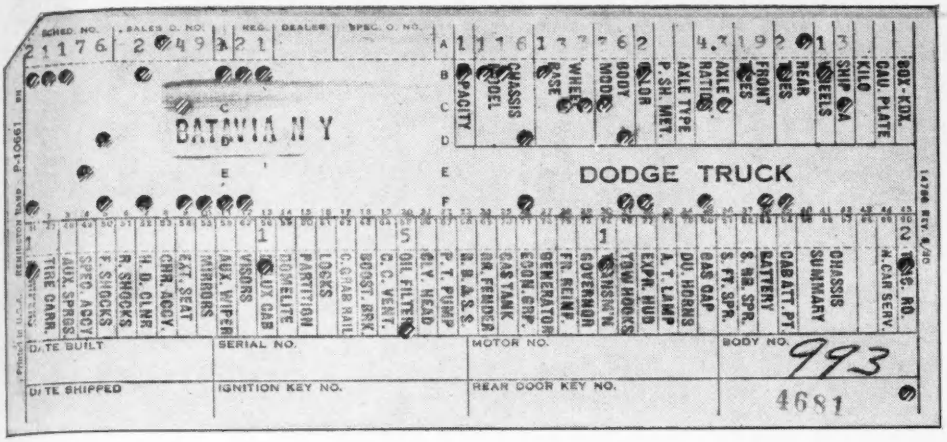
(Below) Close-up of one of the steel framing fixtures used for making up cabs by welding the various sections together.



over by means of a mechanical sling.

Meanwhile the cab and panel bodies which have been assembled and painted in the new section come down on the Lowerator from the paint shop and are transferred to the several body assembly and trim lines, the trim department being organized to serve the two major body lines. Here will be found the preparation of trim, building of cushions, a small section for making arm rests, and stations for assembly of door glass to regulator channels. As the bodies are completed they are transferred to the body bank, ready for scheduling and transfer to the chassis assembly lines.

Stake bodies also are assembled and painted in this area and made ready for transfer to the final lines. The same is true of express bodies. In each case there is a self-contained functional setup for painting and assembly, designed for specialization and high productivity. At the same time, at other stations wheels are painted, dried, and assembled with tires according to schedule, then routed to the assembly line down the chutes from the platforms. Brake drums and hub assemblies, on their way to final assembly, are routed through one of two machine lines where the drums are turned to a tolerance of



Scheduling of each individual vehicle is done by means of punch cards such as the one shown here, the information being transmitted by teletype to each of a number of key stations. The card contains all of the information necessary to describe the vehicle and its special features.

plus or minus 0.0015 in. to assure concentricity of the assembly. This is done in heavy duty automatic stub lathes.

Engines received as block-tested assemblies are transferred to the merry-go-round finishing line where operators complete the installation of specified equipment items such as air cleaners, oil filters, governors, fans, throttle linkage, etc., and then on to the final assembly lines for installation into the chassis.

Front axles and rear axles are assembled on individual lines for each of the final lines. Brake support brackets are cold-riveted to the housing by means of hydraulic squeezers of 35-ton capacity, brake shoes are assembled and set for proper clearance prior to installation of the drum and hub assembly. At the same time the brake bands are burnished by means of a special grinding attachment to assure full concentricity.

Each of the final lines also is served by a merry-go-round assembly line for the preparation of complete front end sheet metal assemblies. This is done in several stages. First the radiator core and shell are assembled on a table conveyor line, then transferred to the merry-go-round for installation of sheet metal and fenders. Finishing touches are added off the line, the units inspected, and are ready for transfer to the final line according to schedule.

Naturally it is understood that the various subassembly operations outlined above have proceeded in accordance with schedules so as to meet the proper chassis on one of the final lines at the right time. We stopped earlier at the chassis turnover station. From this

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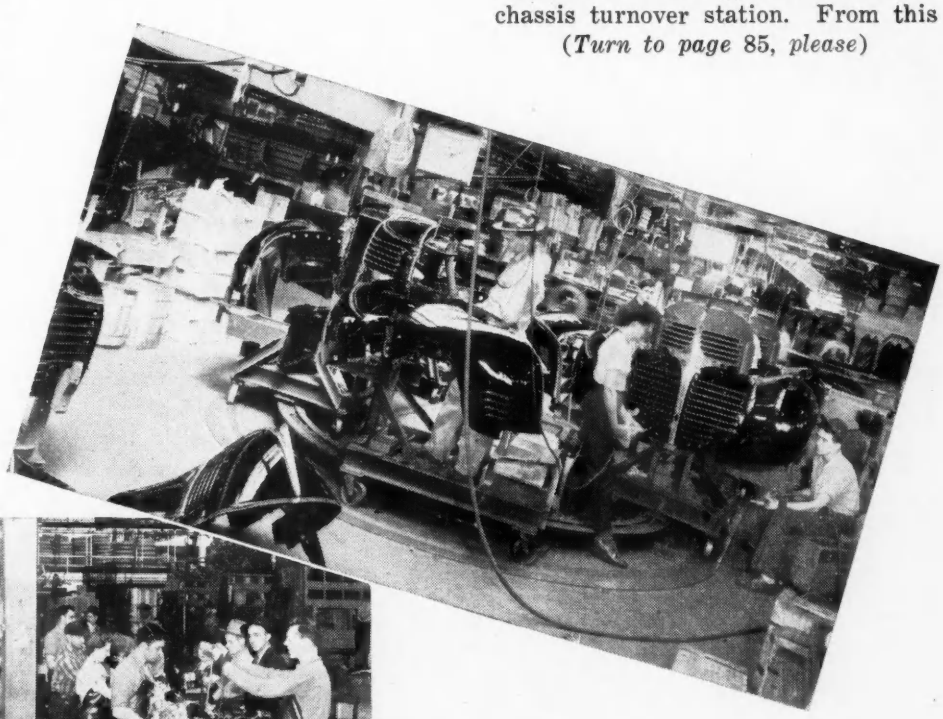
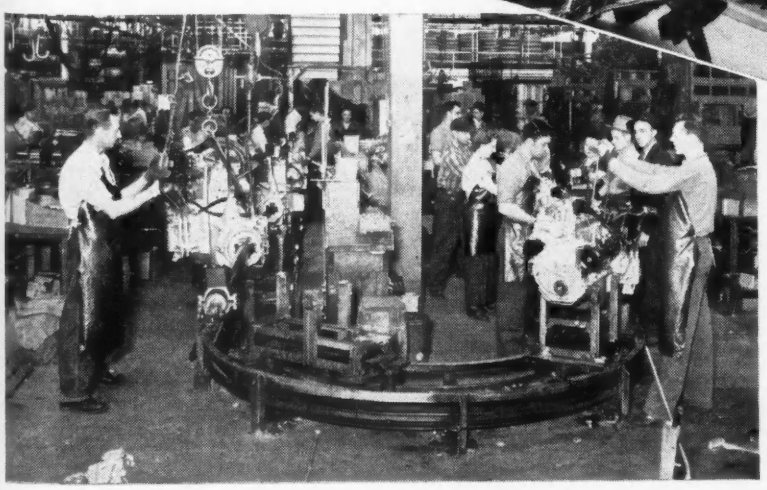
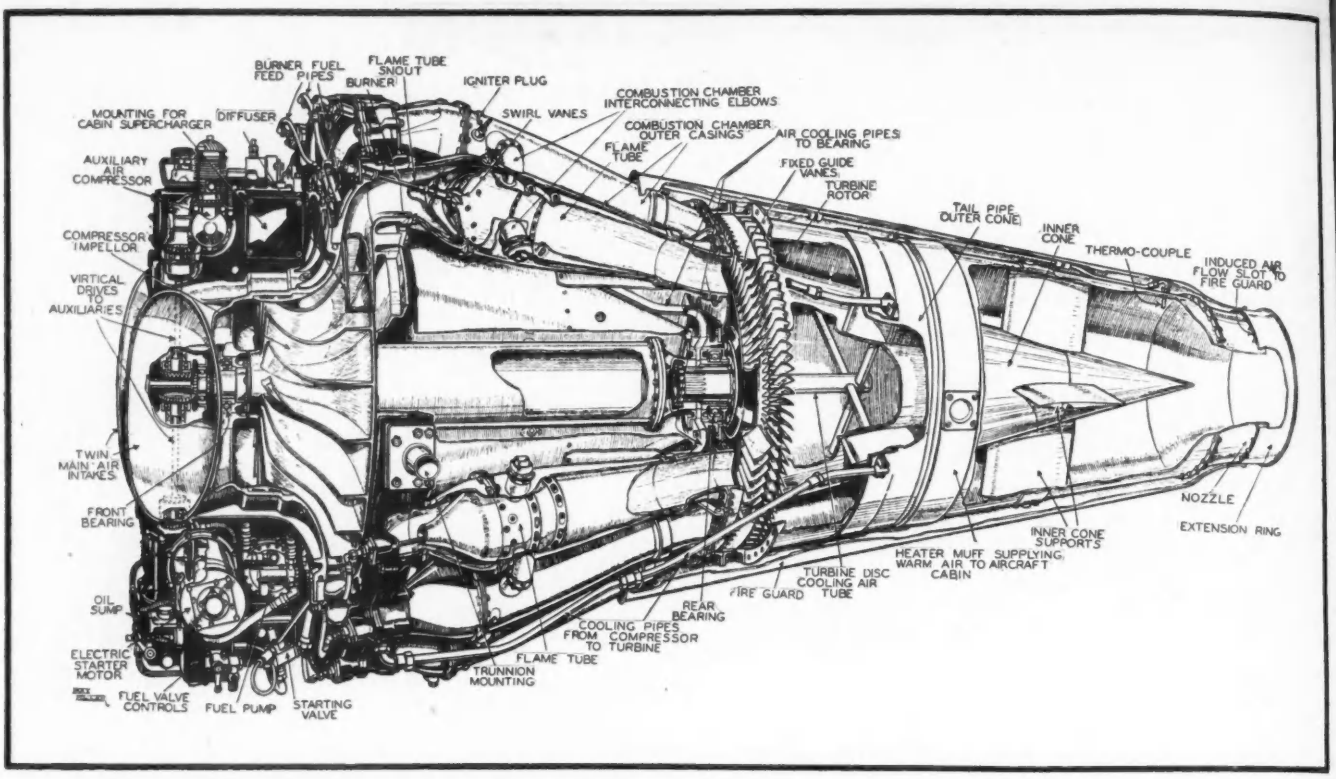


(Right) Here is a perspective of one of the two merry-go-round lines for producing front end sheet metal assemblies. The units then are transported to the final assembly line.



(Left) Perspective of the merry-go-round assembly line for truck engines. Engines are received in block-tested condition, completed by the installation of accessories and special equipment specified on the sales order for each vehicle.



Cutaway drawing of de Havilland Goblin II turbo-jet with an unusual siamesed inlet housing. Note the small reciprocating compressor at the top; just rearward of it is provided a take-off for mounting a Roots type blower for cabin supercharging. (Drawing reproduced by courtesy Flight, London)

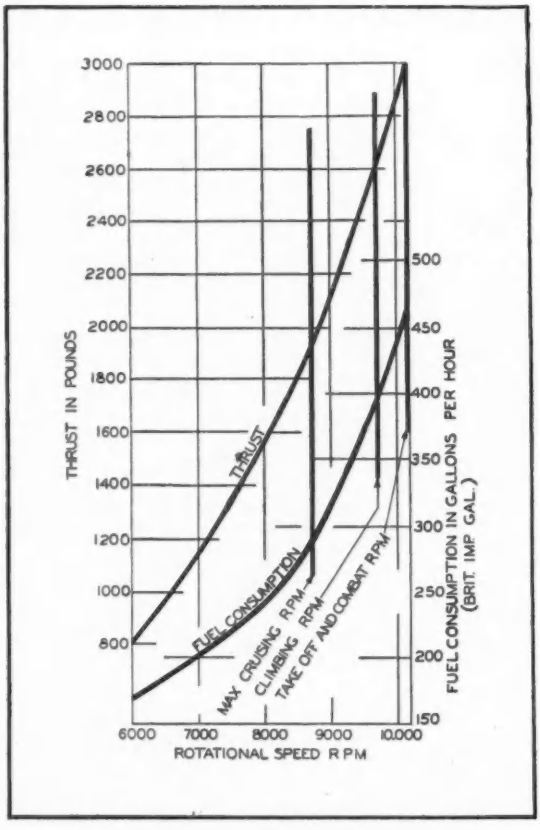


Fig. 1—Goblin II thrust and fuel consumption at zero forward speed and sea level—specific gravity of fuel 0.8; I.C.A.N. atmosphere.

FROM the outset, de Havilland engineers blended the design of the Goblin II jet engine with that of the Vampire airplane. The unique inlet of the engine coupled with the Vampire ducting is said to give a higher efficiency than the alternative feed to a presure box surrounding the engine in that it gives maximum (90 to 95 per cent) conversion of ram, kinetic energy arising from the forward speed of the airplane.

Performance for take-off (see Fig. 1) is given as 3000 lb maximum static thrust at 10,200 rpm with a fuel consumption of 1.23 lb/hr/lb thrust. Jet pipe temperatures are 700 C maximum, cruising 550 C, and climbing 630 C. The curves shown in Fig. 2 give the variation of thrust and fuel consumption with altitude at an airplane speed of 500 mph. The design temperature of gases entering the turbine is 800 C.

The impeller, turbine wheel, and drive shaft make up a single rigid rotating assembly, which is balanced to close tolerances on a Gisholt dynamic balancing machine. Since the 31 in., 17 vane impeller is one-sided and tends to screw into the air like a propeller, it counteracts a large part of the rearward pull of the turbine wheel by tension in the shaft, thus lightening the load that the single thrust bearing has to carry. At the take-off rating, approximately 6000 shaft hp are used in driving the compressor and accessories.

From the diffuser the compressed air enters 16 double-walled combustion chambers, Fig. 3. The air necessary for combustion, about one-quarter of the flow, is supplied to the inner chamber through a metering annulus, that surrounds the fuel burner, and a series of vanes designed to create a vortex and prevent the flame from being blown out. The other three-quarters of the air flows between the double walls providing cooling, and is allowed to enter the inner chamber

Three British Jet Engines

Goblin II, Nene I and F. 3

through rings of ports about halfway along, thus reducing the emperature before the stator is reached.

The single stage, 83 bladed turbine rotor has a tip diameter of 27 in. It is not of the pure impulse type, there being some drop in the gas pressure and corresponding reaction in the moving blades. The blades, tapering slightly from root to tip, vary from 1.3 to 1.1 in. in width, and are mechanically attached in serrated slots broached in the periphery of the disk (see Fig. 4). The slots are parallel with the axis and are lightly peened on each side. Rotation is anticlockwise viewed from the rear. Materials used in these parts are listed in the following table:

Materials Used in the Hot Parts of the Goblin II Unit

Turbine rotor blades, Nimonic 80 individual drop forgings.

Turbine disk, Hecla 153 or Jessops H.3.A. forging.

Stator blades, Jessops G.18B or Nimonic 75 forgings.

Stator rings, H.R. Crown Max. centrifugal castings.

Junction pipe, Inconel sheet.

Combustion chamber, front outer casing, Nickel plated mild steel deep drawing.

Combustion chamber, inner liner, Inconel sheet.

Center structural casing, Stainless steel sheet.

(*Turn to next page, please*)

Fig. 2—Thrust variation and fuel consumption of the Goblin II at 500 mph—thrust hp = thrust × 1.333; specific gravity = 0.8; take-off = 10,200 rpm; climbing = 9700 rpm; cruising = 8700 rpm; I.C.A.N. atmosphere.

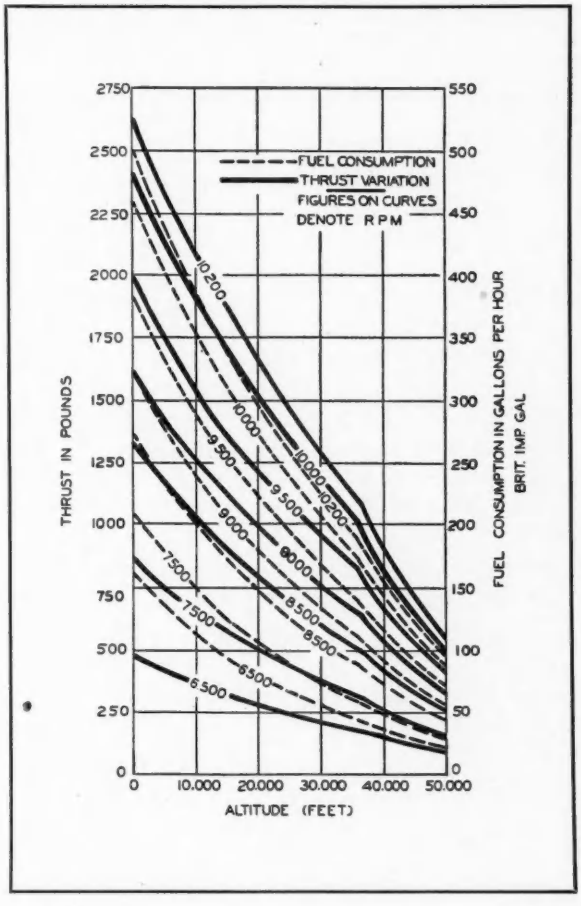
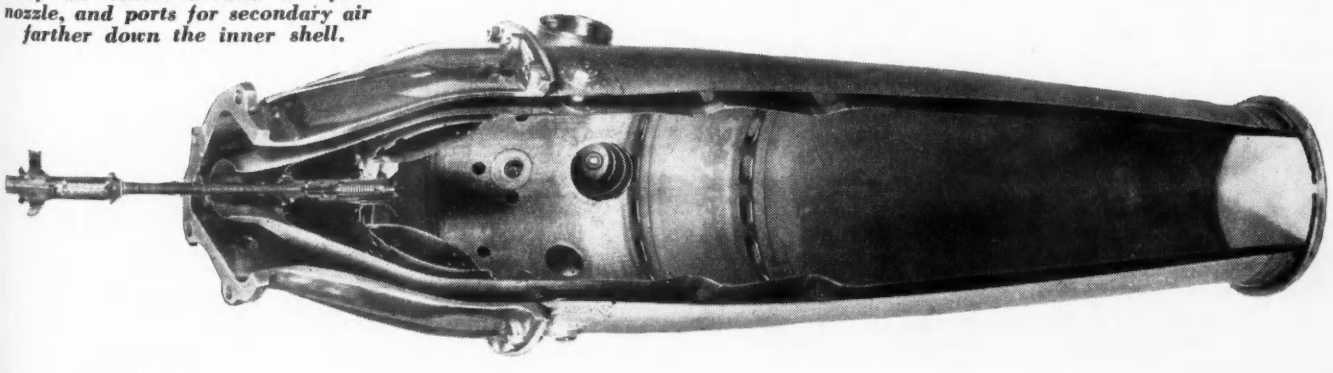


Fig. 3—Cutaway of the D. H. Goblin II combustion chamber showing the swirl vanes where the primary air enters around the fuel nozzle, and ports for secondary air farther down the inner shell.



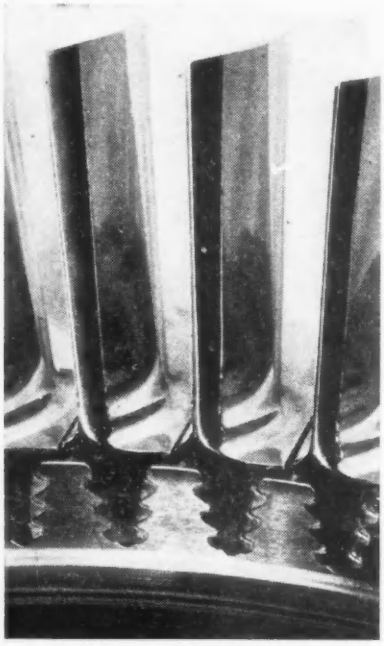


Fig. 4 — Section of the Goblin turbine wheel showing the "Christmas tree" blade anchorage.

Fig. 5 shows details of the Goblin II structural features. Within the jet pipe is an inner cone supported by two pairs of radial streamlined stays. Four lines of small bore leading inwards through these stays convey air from the diffuser casing to the rear face of the turbine disk to cool it. Other pipes feed cool air to the rear bearing, from whence it is spilled outward over the front face of the turbine disk, also serving to eliminate any tendency of the hot gases to creep into the bearing. As air bled directly from the impeller tips is not cool enough for this purpose it is taken first to a cooling passage at the front of the impeller casing. An absence of fans characterize these cooling provisions. The rear bearing, Fig. 6, is mounted in a sliding housing to allow for rearward expansion of the shaft. An annular heater muff for warming the air craft cabin, etc., is built onto the outside of the jet pipe. The pipe is encased in a cowling through which air for cooling and insulating is drawn rearward by the suction created by the jet itself.

Fig. 7 shows the construction of the Goblin burner nozzle. Starting is controlled by an automatic, timed cycle of events. An electric motor of 9 to 12 hp is mounted on the front casing. The pilot closes a safety switch to energize the pump and timing circuits and then checks the throttle lever to be sure it is back against the low thrust stop. Following this a manual fuel valve is opened and he presses the starter button. The motor receives current through starting circuit resistance. This supplies break-away torque allowing the engine to accelerate slowly for six seconds. At the end of this initial period, part of the resistance kicks out, the motor increases the speed, and the pump circuit is energized. In about 17 sec the pressure builds up in the accumulator to the required 40 psi, at which time the starting valve opens to the fuel manifold. Full voltage is imposed on the motor when 5 psi pressure is reached in the distributor manifold. This brings the engine rpm up to approximately 1500 and the two igniter plugs flash the fuel spray into flame. The cross-over tubes between chambers start combustion at the remaining burners. A warm-up period of three minutes at 5000 rpm is recommended before take-off with full throttle.

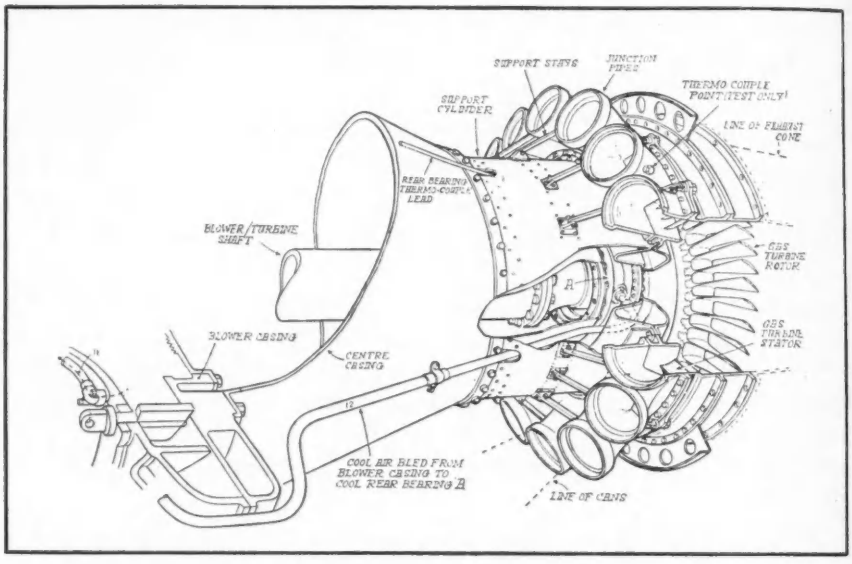


Fig. 5—Cutaway drawing from **The Aeroplane,** *London, showing the structural details of the Goblin II jet engine.*

The following s a list of some of the physical details of the Goblin II jet engine:

Maximum diameter	49.85 in.
Length to rear flange of standard exhaust cone	100.5 in.

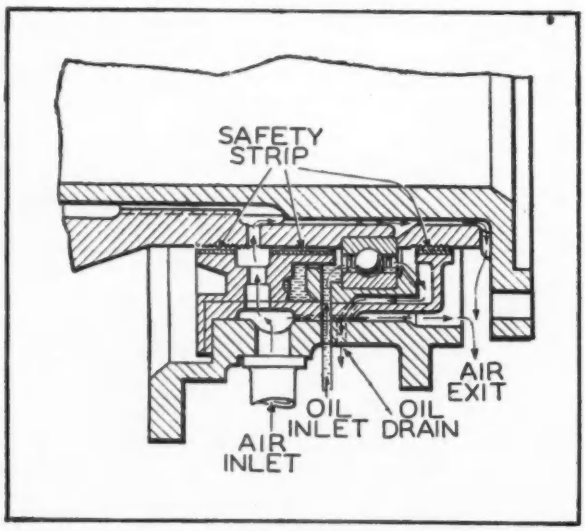


Fig. 6—Details of the Goblin's sliding rear, air cooled bearing (drawing from **Flight,** *London).*

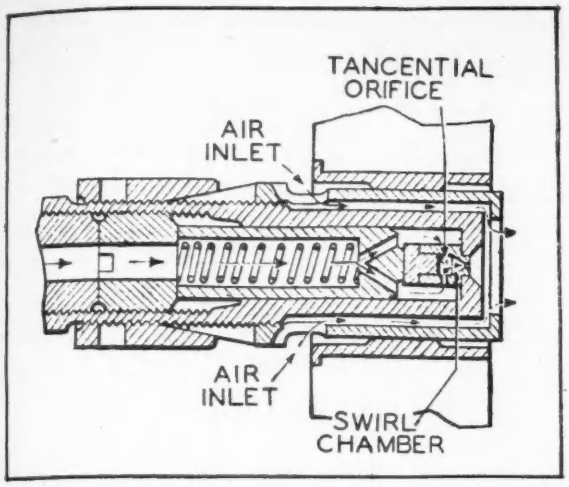


Fig. 7—Detail drawing of the fuel nozzle of the Goblin burner (Flight, London, drawing).

Standard exhaust cone length	43 in.
Propelling nozzle length	6.25 in.
Nacelle diameter in the Vampire	54 in.
Compression ration, approx.	3.5 to 1
Impeller tip speed at 10,200 rpm	1380 fps
Jet pipe orifice diameter	16 in.

Breakdown of Weights:

Diffuser casing	278 lb.
Diffuser rear half	103
Center casing	67
Support cylinder	31
Stator assembly	112
Combustion chambers	289
Rotating assembly	337
Tail pipe assembly	140
Turbine bearing house	19.5
Engine accesories	68
Miscellaneous	105.5
Total dry weight	1550

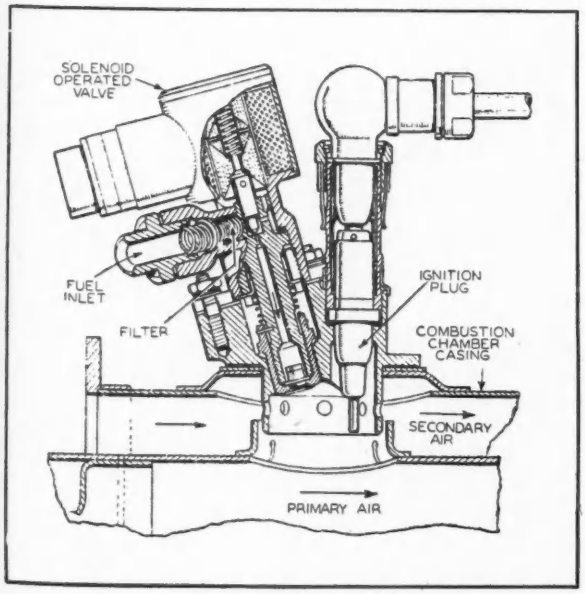


Fig. 9—Igniter assembly as it is installed in the Rolls-Royce Nene I (Flight, London drawing).

Rolls-Royce Nene I

The Rolls-Royce R.B.41 Nene Series I is the largest of the "River" class jet engines thus far announced by the British. It has a two-sided centrifugal impeller and is a direct descendant from the original Whittle engine. However, it utilizes through combustion and many other refinements. The impeller has 29 vanes on each side machined to 28.5 in. diameter from a forging. An inducer of 17.75 in. diameter is fastened to each side of the impeller forming the

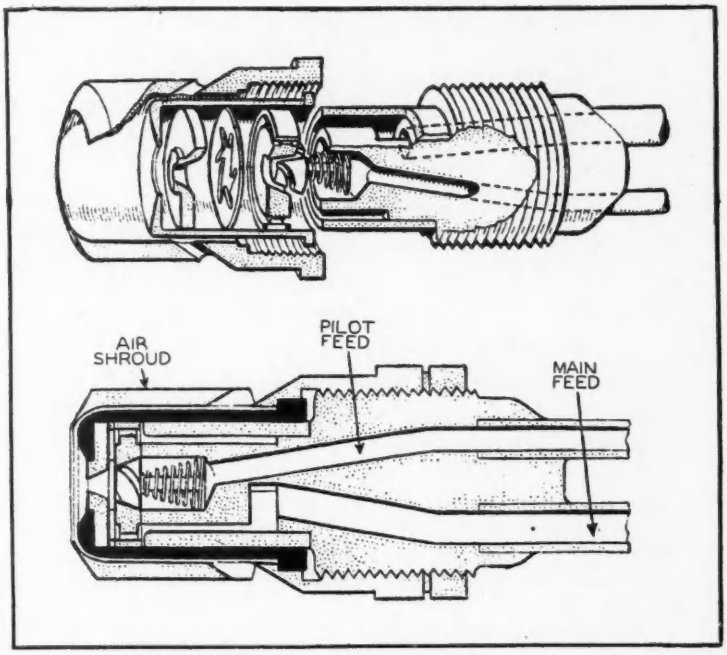


Fig. 8—Sectioned and exploded assembly view of the duplex fuel nozzle used in the Nene I (Flight, London, drawing).

entrance part of the vanes. The design compression ratio is 4 to 1.

The first Nene was designed and built in 1944 and is very much similar to the Derwent V. However, it is not an enlarged version of that unit, the converse being true; the Derwent V is a scaled down model of the Nene. There are nine individual combustion chambers which bolt to the flanges of the tangential outlets from the compressor diffuser casing. Downstream fuel injection nozzles (see Fig. 8) are installed in the primary air metering orifice in the end of the inner liner. Igniters are fitted into two of the chambers (see Fig. 9) for starting but no ignition is required once the engine is running. Cross-over flame tubes link each burner with the adjacent burners. Much of the detail of the combustion chambers and the structural features of the unit can be seen in the cutaway drawing, Fig. 10, by J. H. Clark.

This Rolls-Royce model differs from their other turbo-jets in that it has an integral oil tank which is

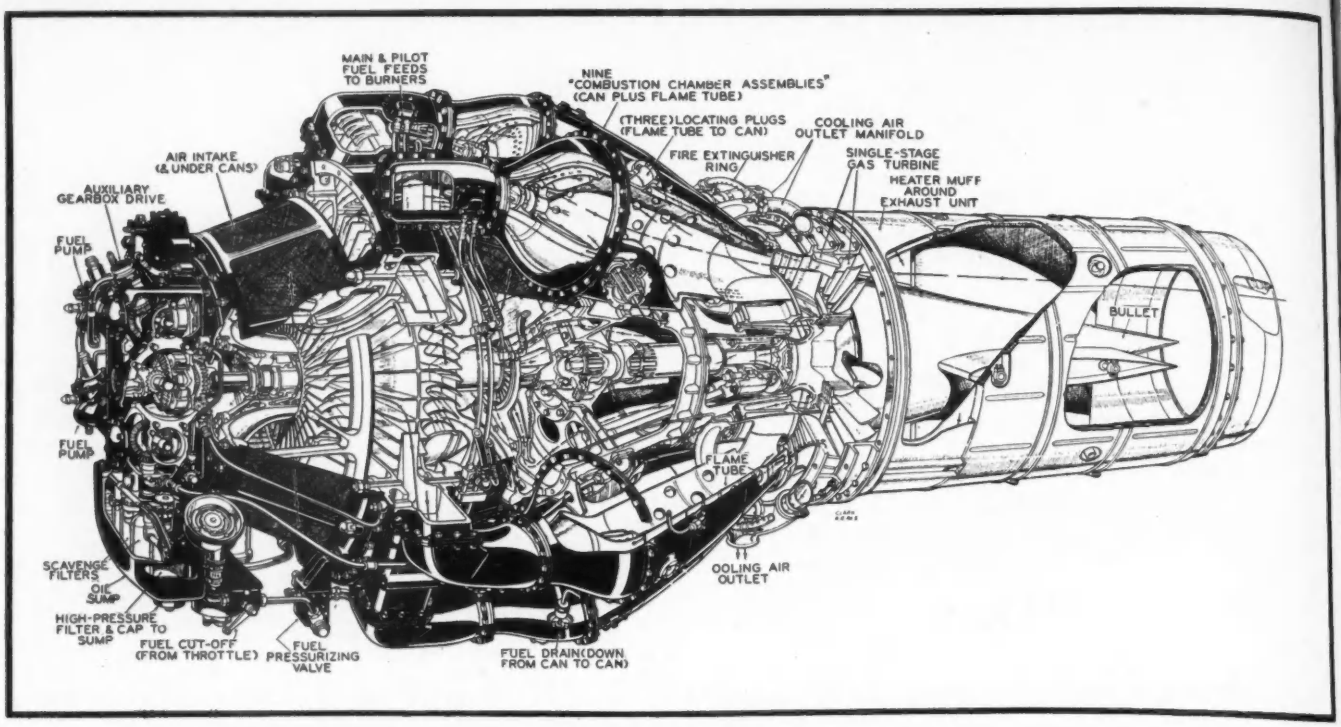

MAIN & PILOT FUEL FEEDS TO BURNERS
NINE "COMBUSTION CHAMBER ASSEMBLIES" (CAN PLUS FLAME TUBE)
(THREE) LOCATING PLUGS (FLAME TUBE TO CAN)
COOLING AIR OUTLET MANIFOLD
FIRE EXTINGUISHER RING
SINGLE-STAGE GAS TURBINE
HEATER MUFF AROUND EXHAUST UNIT
AIR INTAKE (& UNDER CANS)
AUXILIARY GEARBOX DRIVE
FUEL PUMP
BULLET
FUEL PUMP
FLAME TUBE
COOLING AIR OUTLET
SCAVENGE FILTERS
OIL SUMP
HIGH-PRESSURE FILTER & CAP TO SUMP
FUEL CUT-OFF (FROM THROTTLE)
FUEL PRESSURIZING VALVE
FUEL DRAIN (DOWN FROM CAN TO CAN)

Fig. 10—Rolls-Royce R. B. 41 Nene Series I cutaway drawing reproduced by the courtesy of **The Aeroplane**, *London.*

mounted on the accessories housing in front of the forward air intake. The lubrication pressure pump is located in this sump and supplies oil by means of external lines to the three main bearings, one in front of the main impeller, one just after the cooling air impeller, and the other at the turbine end of the main shaft. The casing around the main shaft just behind the front bearing is vented to the high pressure area of the compressor diffuser to prevent leakage of oil into the impeller eye due to the low pressure at that location. The oil circulation path is completed by return lines to a scavenge pump, also located in the sump, that sends it to a "deairator" from which it falls to the bottom of the sump. No provision is made for oil coolers.

Cooling air is taken in just after the main compressor rear inlet. An impeller, very much similar to that in the supercharger of a piston engine, pumps air through the main structural cone surrounding the center bearing and drive shaft, in and around the rear bearing housing, and over the face of the turbine disk. Here its direction is reversed. The cooling stream enters an annulus from which it flows out through tubes between the combustion can into an exhaust manifold surrounding the unit near the front end of the nozzle box assembly.

Fig. 11 gives the estimated performance of the Nene at a forward speed of 500 mph. Fig. 12 shows test stand static performance. The following table lists some of the design details of this turbo-jet.

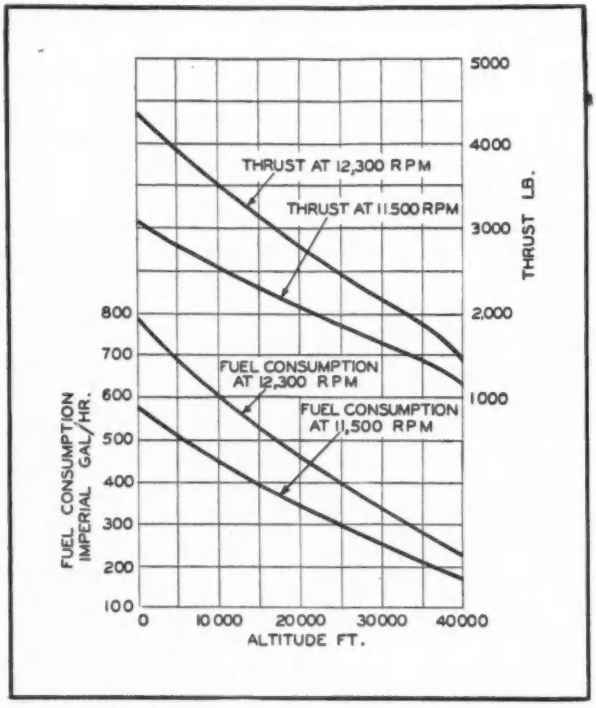


Fig. 11—Performance of the Nene I estimated for a forward speed of 500 mph; fuel is kerosene plus one per cent of lubrication oil giving a specific gravity of 0.806.

Details of the Rolls-Royce Nene Series I Jet Engine

Length, including 32.9 in. exhaust cone	96.8 in.
Diameter, maximum	49.5 in.
Weight, dry	1550 lb.
Oil sump capacity	5 qt.
Single stage turbine blade material	Nimonic 80
Turbine disk material	Jessops G.18B

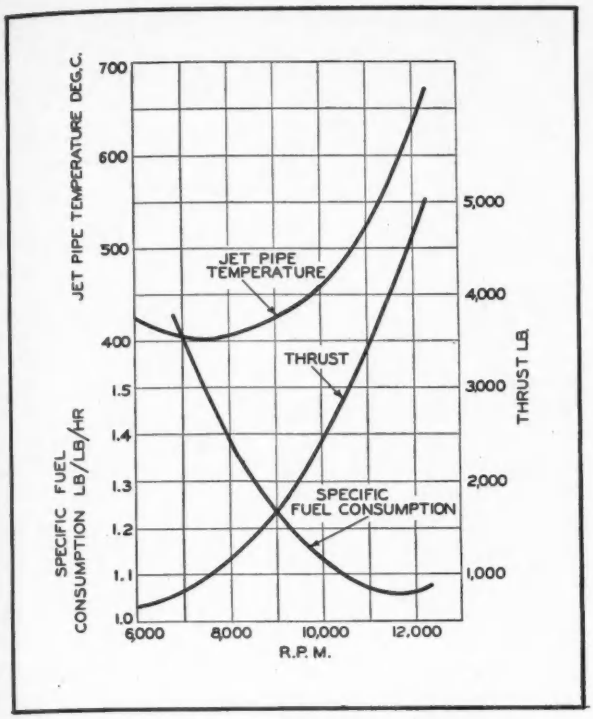


Fig. 12—Static performance of the Nene I as determined from test stand operation.

Nozzle blade material	Nimonic 75
Thrust, maximum static at 12,300 rpm	5000 lb.
Temperature into nozzles at maximum rating, approximately	875 C
Compression ratio	4 to 1
Impeller tip velocity at rated rpm	1530 fps
Turbine rotor mean blade velocity at rated rpm	1070 fps
Acceleration 2500 to 12,3000 rpm	4.5 sec.

Metropolitan-Vickers F. 3

Metropolitan-Vickers, Ltd., an outstanding British builder of steam turbines for many years, is the designer and builder of the most efficient gas turbine-jet engine about which details have been released to date. Specific fuel consumption of the F.3 is quoted at 0.65 lb/hr/lb thrust near maximum power (see Fig. 13). This performance is attributed largely to the ducted-fan thrust augmenter illustrated in the cutaway drawing Fig. 14. The fan is driven by two counter-rotating, two-stage turbine disks which are in addition to the two-stage turbine rotor disk that drives the main compressor. The arrangement of the blades is most interesting in that there is no stator, the 58 blades of the first stage of the fan being integral with the first and third rows of driving blades, which

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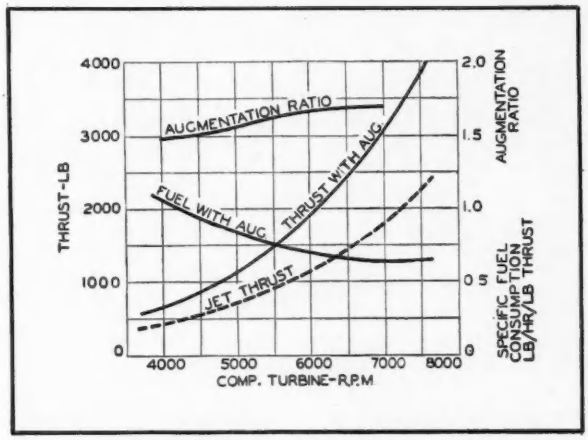


Fig. 13 — Static performance of the Metropolitan-Vickers F.3 turbo-jet with a ducted-fan augmenter showing the relation of the total thrust to the jet alone.

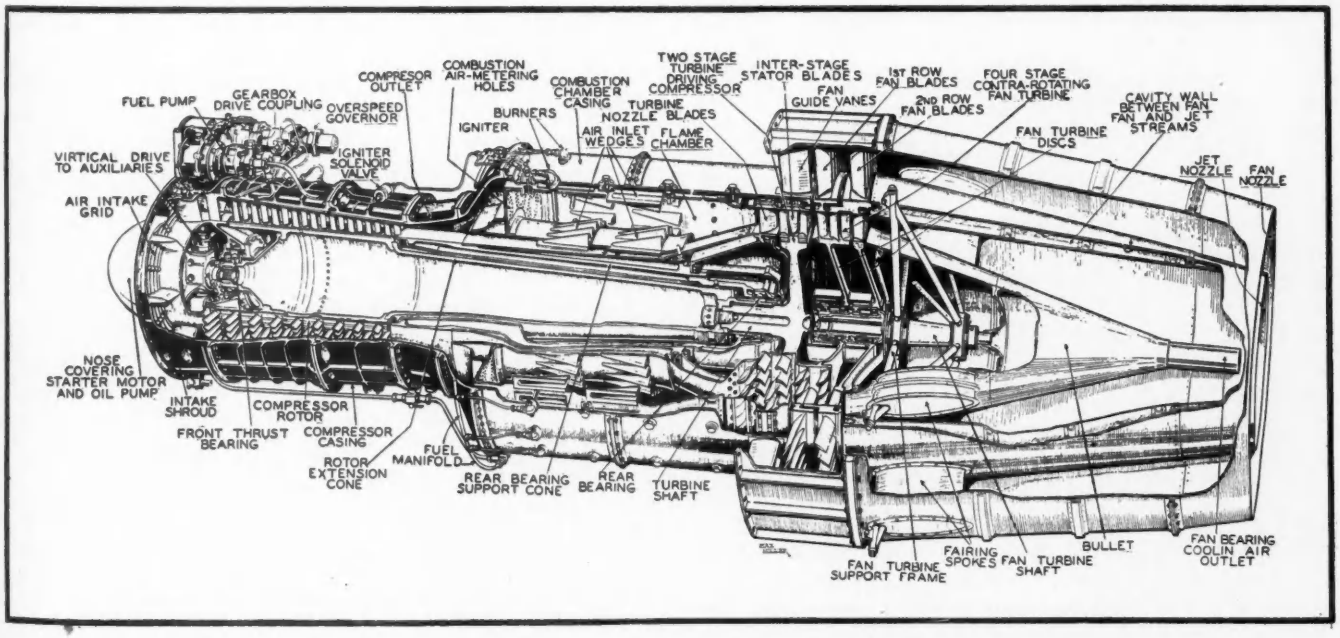
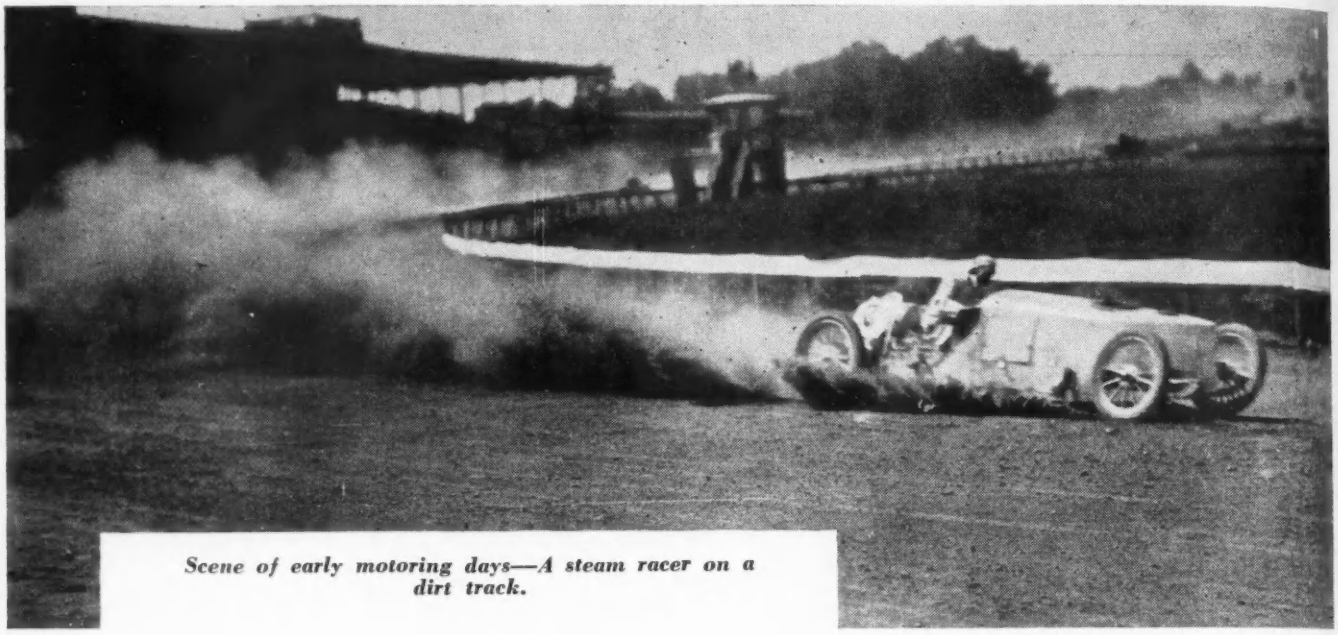


Fig. 14—Cutaway drawing of the Metropolitan-Vickers F.3 aircraft power plant, showing the structural features of the ducted-fan thrust augmenter, reproduced by the courtesy of* Flight, *London.



Scene of early motoring days—A steam racer on a dirt track.

Rise and American

Steam cars usually showed up to advantage in hill climbs and races, particularly in short-distance events. Engine power could be greatly increased by the simple expedient of resetting the controls for operation at higher pressure, and the large store of energy in the superheated water in the boiler also was of help. That a great deal of energy was stored in the boiler was shown by the fact that if the fire was shut off when the boiler pressure was normal, on good roads, the car would run for about two miles before it came to a stop. A world's speed record of a mile in 29 3/5 sec was established by F. H. Marriott at Daytona Beach, Florida, in January, 1907, in a special Stanley racer dubbed the Tea Kettle.

LESS meteoric than the rise of the Locomobile was that of the Whitney-Stanley or McKay steamer, which was manufactured at Lawrence, Mass. Its price of $1800 seemed very high at the time, especially when compared with the $600 asked for the Locomobile; but from the mechanical standpoint it was a very creditable production.

Another concern which figured quite prominently in the early history of the steam car—and of automobiles generally—was an offshoot of the American Bicycle Co., popularly known as the Bicycle Trust. In 1901 the automobile business of the "Trust" was separately incorporated as the International Motor Car Co., with A. E. Schaaf, previously New England Manager for the Gormully & Jeffery Co., of Chicago, as president. At that time the rights to a steam car designed by F. C. Billings of Hartford, Conn., were acquired, and the first machine built was exhibited at the Madison Square Garden Show in New York in November, 1900. The car was named the Toledo and was placed in production in the former Lozier bicycle plant in Toledo, Ohio.

While most of the light steam cars carried fire-tube boilers, the Toledo was equipped with a water-tube boiler. A diagrammatic sectional view of this boiler is shown herewith (Fig. 11). It consisted of two seamless steel shells, bolted together at top and bottom to form the water and steam spaces between them. Within the inner shell there were eight conical coils (only one of which is shown), the ends of which were secured into the inner shell near the top and bottom respectively.

Water-tube boilers were largely used in stationary and marine powerplants at the time, because the construction facilitated circulation of the water and transfer of heat, and the heating surface required per horse power output was less than with fire-tube boilers.

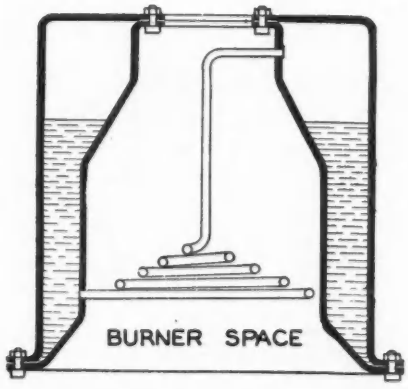


Fig. 11 — Sketch of Toledo boiler, showing one of the eight coils.

Part Three

Part Two appeared in the Aug. 15 issue. Part Four will conclude the series in the September 15 issue.

Decline of the Steam Car Industry

By P. M. Heldt

However, for given overall dimensions and a given weight there is usually less heating surface in a water-tube than in a fire-tube boiler.

A characteristic of the Toledo steamer was that it, the same as another popular steam car to be referred to later, was built without the conventional dashboard. The machine was of much heavier design than the Stanley, weighing 1450 lb with all supplies on board. One of its shortcomings was insufficient steaming capacity for heavy roads. The engine was completely enclosed and had balanced piston valves instead of slide valves, which reduced the losses due to valve friction. An auxiliary hand feed pump was combined with the steering tiller, so that the driver could assist the crosshead pump when necessary by moving the steering tiller up and down like a pump handle. A sectional view of this pump is shown in Fig. 12.

A flash boiler has been defined as one in which there is no water level. These boilers usually consist of coils or lengths of pipe which are so connected together that they form a continuous passage into which water is fed at one end and from which steam is drawn at the other end. In a true flash boiler the water enters at the end nearest the fire, and flashes into steam instantly, as this part of the boiler is usually near red heat. Such a flash boiler was developed for automobile use in France by Leon Serpollet. In this country a number of flash boilers had been installed in steam yachts by the Herreshoffs in pre-auto days, and Elihu Thomson of the General Electric Company had done some development work on them with a view to their adaptation to road vehicles, but no American car equipped with a true flash boiler went into production.

In 1900 the White Sewing Machine Co. of Cleveland, Ohio, placed on the market a medium-weight steamer equipped with what was described as a semiflash boiler. A plan and side view of the coil assembly of this boiler are shown in Fig. 13. It consisted of 13 superposed horizontal spiral coils of ½-in. copper tubing, except for the lower, superheating coils, which were of steel. Between coils there were narrow separating pieces, which supported them and also held them in place laterally. The coils were enclosed in a thin sheet-steel housing lagged with asbestos.

Both ends of each coil were carried to the top of the boiler, where the outer or outlet end of one coil connected to the inner or inlet end of the one next below it by a horizontal pipe. A crosshead pump forced water into the inner end of the topmost coil, and steam was drawn from the outer end of the bottom coil. The water turned into steam in one of the bottom coils, the exact point changing with operating conditions, but it usually was sufficiently high so that the steam was superheated to about 800F in the coils below it.

In a boiler of this type the pressure depends on the amount of water in it. When this decreases the pressure rises, and vice versa. It was therefore necessary to control the feed automatically, and a feed regulator was fitted which was so designed that an increase in the boiler pressure above normal

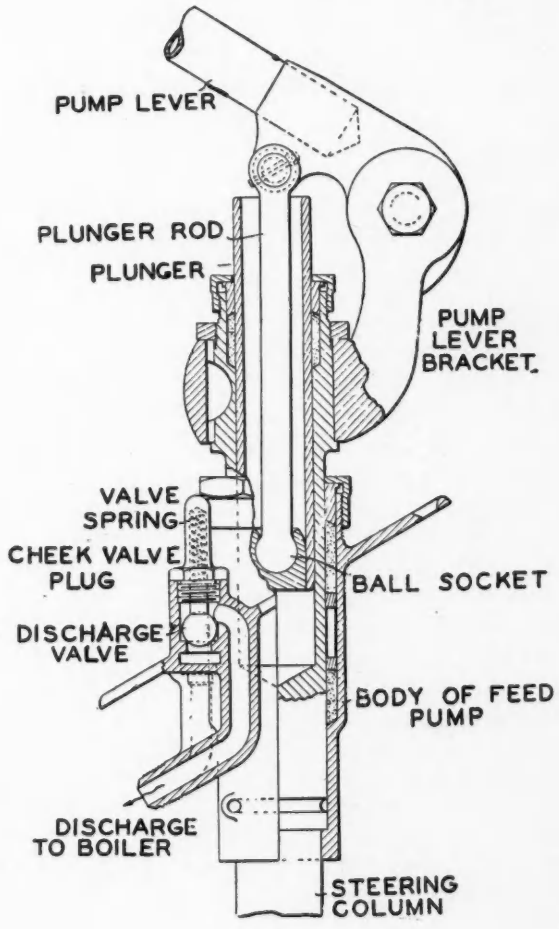


Fig. 12 — Hand feed pump combined with steering tiller.

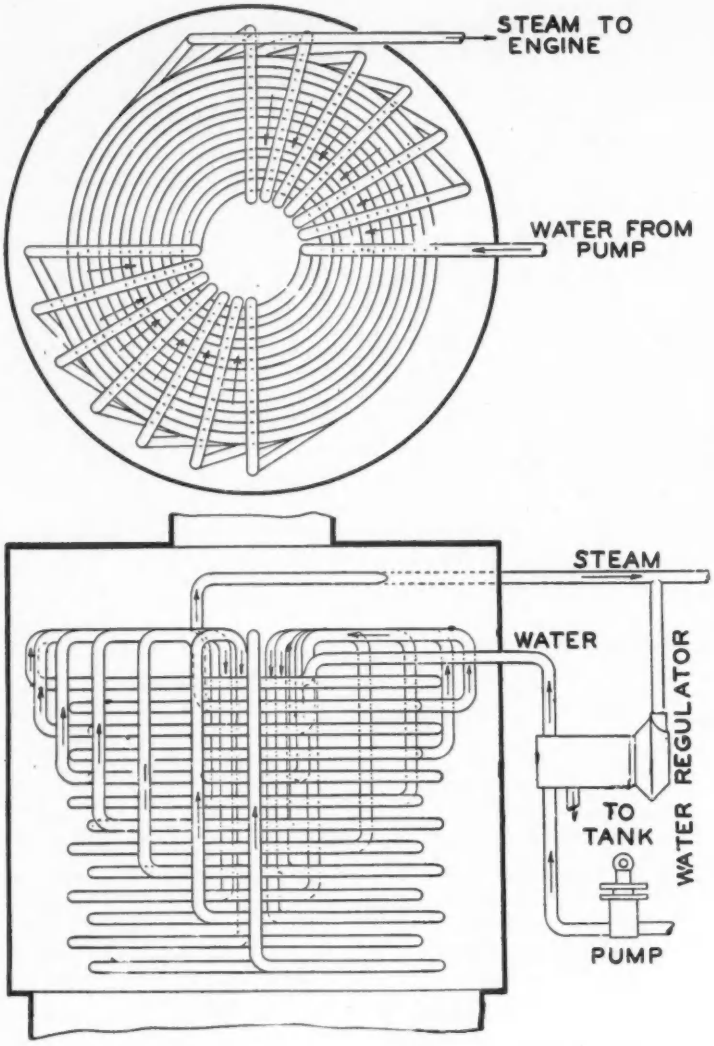


Fig. 13—Plan and elevation of White semi-flash boiler.

closed the bypass valve and let all of the water delivered by the pump enter the boiler. If this resulted in an excess of water in the boiler, the pressure dropped and the bypass opened again. The regulator was adjusted to maintain the pressure at about 200 psi, but the safety valve was set to open only at 500 psi, the tubes having sufficient strength to safely withstand this pressure.

Fuel feed was automatically controlled by a thermostatic device, and a sectional view of this regulator is shown in Fig. 14. It included a tubular casing which formed the connection between the lowest and next-to-the-lowest boiler coils. Within the casing and secured to the head thereof was a copper tube which was closed at its outer end and contained a steel rod that acted on the fuel valve through a bell crank. When the steam temperature rose above normal, the greater expansion of the copper tube as compared with the steel rod, caused the protruding end of the latter to withdraw and allow the fuel valve to close. Reduction of the steam temperature had the opposite effect and opened the valve.

The engine of the White steamer was a two-cylinder vertical one, with slide valves and Stephenson-link reversing gear. The reversing lever extended forward through a slot in the kneeboard of the car and moved on a notched sector, so that it was positively held in place. The need for such an arrangement was emphasized by rather unpleasant experiences of owners of other light steam cars. With these machines it would sometimes happen that when the driver opened the throttle to drive off, the car would start backward instead of forward. The reason for this, of course, was that the position of the reversing gear had been reversed by the inertia of a sudden stop. A photo of one of the early White steamers is shown in Fig. 15.

A lot of one-hundred of these steamers passed through the shops during the spring of 1901. One of the cars took part in the New York-Buffalo endurance contest of that year, and later was exhibited at the Pan-American Exposition in Buffalo. These steamers came prominently to the front the following year, when five of them took part in the New York-Boston-and-back endurance contest, in which all of them made perfect scores. The competing vehicles were equipped with condensers located at the front, which enabled them to complete the half-day stages of about 50 miles without stopping to renew their water supply. The White steamer was the design of Rollin H. White, a graduate in mechanical engineering of Cornell University.

A number of other improvements made in steam cars and their equipment may be briefly mentioned here. One of the inconveniences of the light steamer was that the water supply of about 20 gallons had to be renewed every 20 or 25 miles. If service stations had been as numerous as they are today on the

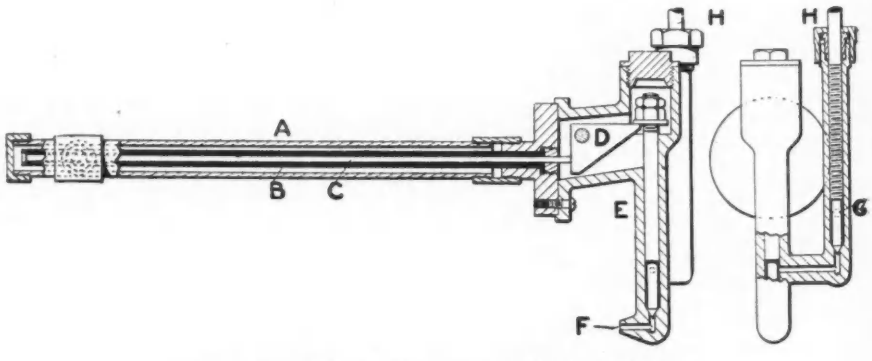


Fig. 14—White thermostatic fuel regulator.

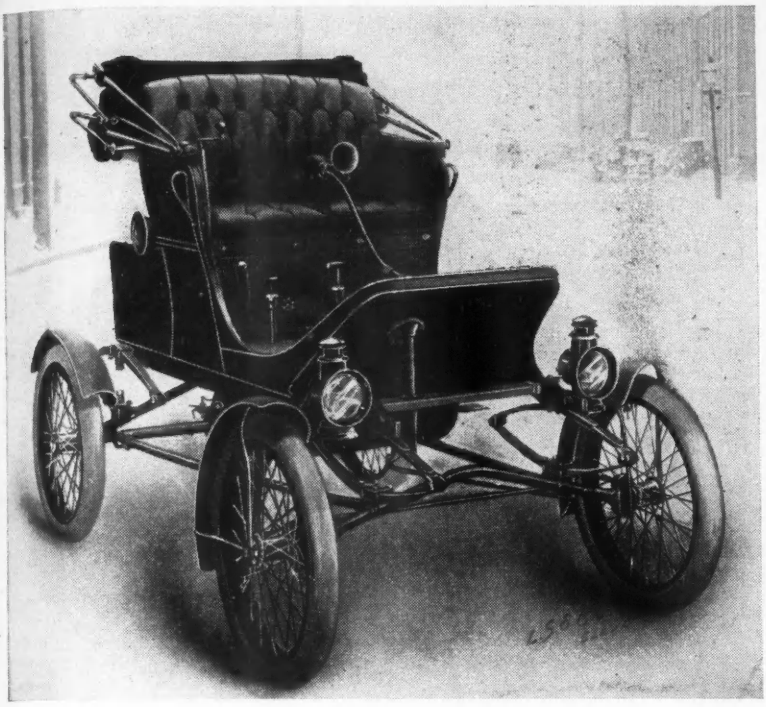


Fig. 15—The first White steam car.

heavily-traveled main roads, this would not have mattered very much, but the day of roadside service for automobiles had not yet dawned. Originally a rubber pail was carried on the car, but it can be readily imagined that searching for a source of water every hour or so, and then transferring 20 gallons or more to the tank of the car with a rubber pail detracted greatly from the pleasures of motoring. The task of replenishing the water supply was facilitated by the installation on the car of a siphon or steam ejector and a length of rubber hose. With this equipment, all that was necessary was to place the end of the hose in a pond or brook—provided one was handy—and open the steam valve. The equipment referred to is illustrated in Fig. 16.

The steam consumption of early automobile powerplants was very high, and various means were resorted to with a view to making the engines more efficient, including compounding. With a two-cylinder compound engine, if the high-pressure cylinder was of the same size as each of the cylinders of a two-cylinder simple engine, the maximum torque which the engine could produce was necessarily a good deal less, and a type of valve gear was therefore provided which made it possible to admit live steam to both cylinders whenever conditions called for it, as in climbing steep grades.

A very ingenious control valve, used in Stearns compound engines, made it possible to operate the engine either simple or compound, as desired, and also acted as a reversing means, obviating the need for a special reversing gear. A sectional view of this control valve, together with adjacent parts, is shown in Fig. 17. The engine had one high-pressure and one low-pressure cylinder, parts of which are shown in the drawing at the left and right, respectively. Both cylinders had balanced piston valves, which are shown, and the control valve, which also was a piston valve, was located centrally between them. This valve ordinarily was fixed in position, but it could be moved by the driver to change the operating conditions. Live steam from the boiler entered the control-valve chest centrally at the top.

When the engine was to be operated compound, the control valve was lowered from the position in which it is shown in the drawing until the passage to the valve-chest of the high-pressure cylinder (on the left) was completely uncovered by the upper edge of the control valve. Steam was then distributed to both ends of the high-pressure cylinder by its piston valve, and the exhaust from this cylinder passed through internal ports in the control valve to the valve chest of the low-pressure cylinder (on the right), whence it was distributed to both ends of that cylinder by its piston valve.

By raising the control valve until the exhaust passage of the high-pressure cylinder was uncovered by the lower edge of the control valve, live steam was permitted to enter that passage, and the direction of rotation of the engine was reversed. If the control valve were lowered sufficiently to uncover the passages to the valve chests of both cylinders, then live steam was admitted to both, and the engine operated as a simple engine.

All or nearly all steam cars other than those developed by the Stanley brothers carried pilot lights for starting the fire and for relighting the main burner after it had been turned off while the car was parked. The pilot light extended through the burner

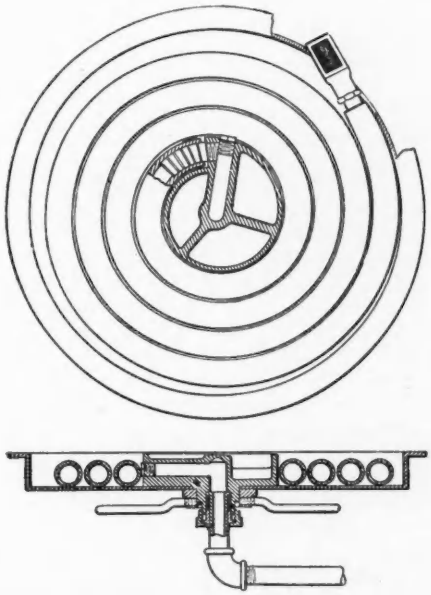


Fig. 16—Siphon for filling water tank.

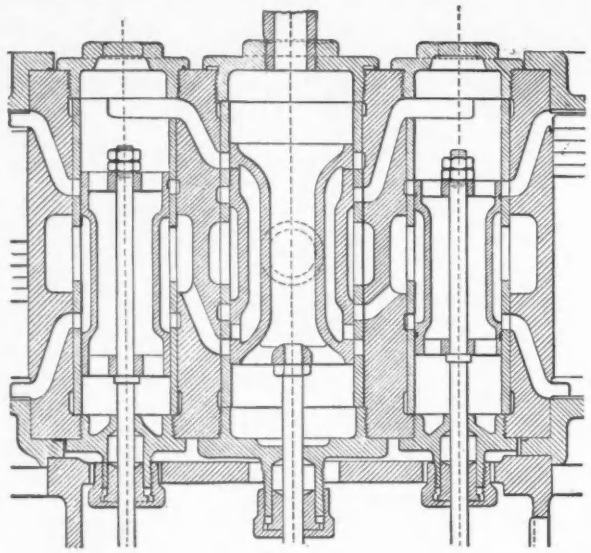


Fig. 17—Stearns control valve for compound engine.

and had a part of the vaporizer located directly above it. One such pilot light is illustrated in Fig. 18.

To judge by the number of patents issued on boiler feed systems, the original system with hand control was most unsatisfactory. The driver had to constantly watch the water gage through the dash mirror, when his eyes should be on the road. Owing to the fact that the check valves sometimes would stick, the gage was far from reliable, and breakage of gage glasses was a major cause of trouble. To this must be added the fact that on heavy roads, where much steam was required, the crosshead pump usually did not deliver enough water to properly maintain the boiler level. Trouble with the feed caused some owners to equip their cars with two additional pumps, a steam pump and a hand pump.

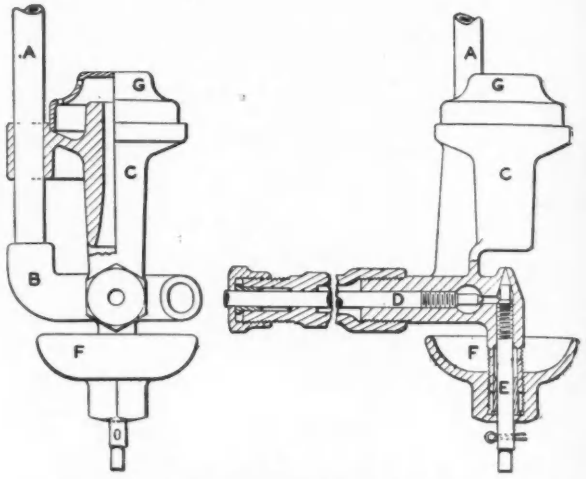


Fig. 18—Pilot light. A, fuel pipe; B, curved gasoline vaporizer tube; C, burner body; G, perforated burner cap; F, fuel cap for starting.

Belgian Automotive Production

. . . Shortages of electrical equipment, textiles and other accessories are preventing the expansion of output in the Ford, Chrysler and General Motors assembly plants that turned out 80 per cent of Belgium's passenger car and trucks before the war. In place of assembling the units, most of the cars and trucks are being imported virtually completely assembled at considerably increased costs.

In today's conditions of artificial demand in a transportation starved market, the added items of a heavy duty on complete cars and $350 or $400 extra freight on Ford are relatively unimportant. The big three American producers as well as the French producers Renault and Citroen who formed the strongest competition are racing to get their assembly plants in Belgium into operation to avoid the import duty as well as excessive freight charges.

Newcomers to the Belgian passenger car market are the British light automobiles which are being imported in small quantnities today. The British producers owned no assembly plants in Belgium before the war, and are engaged only in exporting completed units. They are selling at what Belgian officials call excessive prices, and it seems likely that when the French Renault 7 hp model is arriving in ample quantities the price comparison between the two (75,000 francs Belgian for the British 7 hp model, and 51,000 for the Renault will make the competition difficult for the across-channel movement.

But the prewar favorite in the Belgian market was the American passenger car, and in comparison to the above prices for the light models, Belgians consider a 90,000 franc price level for the three low-price American models to be a big bargain. When the heavy freight charges are considered, the price is competitive. The General Motors plant at Antwerp was virtually completely destroyed by allied bombing during the war, and the firm has leased another building for temporary assembly lines until rebuilding can be completed. Ford was more fortunate, and although their plant suffered some damage it is largely repaired. Although the product was distinctly American, these assembly plants before the war used springs, textiles, glass, wheels, batteries and many other items from local concerns. It is the inability to procure these materials in sufficient quantities locally that is holding up the assembly program in Belgium. For an industry that employed 3000 men in 1938, there are only about 500 men employed today.

To take the place of the 22,000 passenger cars that were assembled a year in prewar Belgium, the government made an allocation of 18 millions of the country's store of dollars for the purchase of 16,000 American cars to be imported from America in 1946. Deliveries to date have been far behind schedule, and Belgian transport officials expect only about 10,000. There is an officially estimated backlog demand of about 50,000 cars before the Belgian market will begin to assume its normal pattern.

The history of the Belgian motor car industry was one of vainly attempting to protect the home industry up until 1935, when the government decided that the policy was resulting only in the artificial maintenance of the price structure on an uneconomic level. A compromise system was developed which maintained a fairly high duty on the importation of completed vehicles, but which reduced the rates on dissembled units and spares to almost nil. Since that year, activities of the American producers have expanded, and the two French firms mentioned above have also shared in the market. Fiat, from Italy, also shared in the light car market, and German heavy trucks were widely used.

The low standard of costs for prewar Belgian labor, despite a high standard of craftsmanship and living, made Belgium popular with the foreign pro-

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Abnormal *Pattern of Replacement* Parts Situation

By Leonard Westrate

THE parts situation today is similar to that of the man pumping water into a bucket with a good sized hole in the bottom. The only way he can make any headway is to pump faster than the water can run out. The pump in this case is the parts industry and the hole in the bucket is the biggest demand for replacement parts that the industry has ever seen. At present, the pump is going like mad, twice as fast as in 1941, but the war tore a hole more than twice as large in the bottom of the bucket too, so the water level, or parts inventory, is much lower than before the war. All of which is just another way of saying that replacement parts production is more than double that of 1941, but the demand has been so phenomenal that shortages now are the worst in history. To carry the analogy just a bit further, the sensible thing would be to plug the hole, of course. However, if that can't be done the next thing is to pump even faster or to get a bigger pump. That's what the industry is doing.

Merely to say that production can't keep up to demand and let it go at that admittedly is an oversimplification of the problem. Actually, the whole replacement parts picture has been cut up into a scrambled, complex jigsaw puzzle by the dislocations of a war economy and it will take a good deal of time and skill to get it fitted back into a semblance of a normal pattern. It is even hard to get a coherent story of what has happened and what may happen because conditions vary so much between different sections of the country, between one manufacturer and another, and even between different parts categories.

There are several factors contributing to the present parts shortage. During the war production of non-functional parts, such as fenders, hoods, and other body parts, was outlawed by the War Production Board. In addition, manufacture of all allowable parts was restricted in 1942 and 1943 and shortage of materials caused a further restriction, with the result that output of parts was below that of 1940 and 1941. In 1944, the orders were changed to permit increased parts manufacture and materials were allocated. However, nearly three years of low production was not enough to keep up with the increased demand caused by the absence of new cars in the market. As the age and dilapidation of old cars increased, the demand grew proportionately. In a normal situation, the manufacturer estimates the number of repair parts that will be required to service a model run for all time and then makes that number, after which the dies are scrapped. In the case of older cars, the long time estimate simply was not high enough to take care of the unprecedented situation brought on by the war. In addition, some companies scrapped parts dies during the war at the insistence of WPB, which wanted the metal for scrap. Most of the automobile companies resisted such action successfully or the shortage would be much worse than it now is.

The reconversion period also put a crimp in parts production. During the changeover from war goods to peacetime products, plants were shut down for inventories and some plant clearance, with the result that fewer parts were built during that time. In certain lines, vendors dropped out of the business, making it necessary to find a new source and causing further delay. Inventory problems also have complicated the picture, since there now are many new car dealers and independent repair shops which must be stocked. In addition, some shops are carrying inventories much higher than ever before. The end of the war and lifting of gasoline rationing greatly increased driving, with the result that cars now are wearing out much faster than they did in the war period.

It also should be remembered that the present low level of new car production has a double-edged bearing on the shortage of parts. On the one hand, with fewer new cars coming into the market to replace those which could be junked, more cars have to be cobbled up and kept running. Many of them are so decrepit that they take a supply of new parts entirely out of proportion to the value of the car. Also, the same

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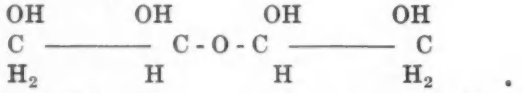
Use of

IN THE German aircraft gasoline engine it was recognized, that the weakest part, especially for high-altitude operation, was the spark plug. Not only was it necessary to take unusual precautions to avoid ignition difficulties at high altitudes (for instance special high-altitude spark plugs, dual ignition, specially insulated cable, pressurized harness) but it was also necessary to avoid fouling of the spark plugs by limiting the lead content of high-test gasoline. The Ring Process is an invention for the elimination of the spark plugs. Ignition is produced by spraying into the combustion chamber, at the right moment of the gasoline-air compression stroke, a liquid that will spontaneously ignite at the temperature of the cylinder, and thus ignite the combustible charge.

The process, already mentioned in the writings of Dr. Rudolf Diesel in 1898 was developed by Dr. Fritz Penzig of I. G. Farben Industrie A.G. at Oppau in 1940-41 and perfected in cooperation with the Bayerische Motoren Werke of Munich in 1942-43.

The ignition liquid used, called "R-Fluid" is an ether such as butadiol diethyl ether, or diethyl diglycol ether of formula:



It is designated in Germany under symbol R-300 and has the following properties:

Comparison of R-300 with Aviation Gasoline

	R-300	Aviation Gasoline
Spec. Gravity	0.91	0.75
Viscosity CS at 20 C	1.5	0.6
Distillation E. P., °C	180	200
Calorific Value kcal/kg.	6900	10,400
Theoretical air required kg./kg.	9.3	14.8
Ignitability in Cetane rating	185	up to 35

It is to be noted that R-300 can also be used as starting fluid for Diesel engines, in which case it is designated as KS II.

The self-ignition quality of R-300 appears to be due to a rapid disintegration of the molecule under the action of heat, an exothermic reaction producing a rapid rise in temperature which causes the products of decomposition to ignite, at about 70 C. On account of its high ignitability, R-300 is not particularly affected by changes in the compression-ratio, and operates down to a compression ratio of 7 to 1. In practice 8 to 1 is the minimum compression ratio selected. One of the interesting features of this process is that it operates with correct ignition from the leanest up to the richest air-fuel mixtures. This can be explained by the high energy of spray of R-fluid, estimated at 70 kcal as against an energy release of 10 kcal coming from a spark plug. The only condition for the igni-

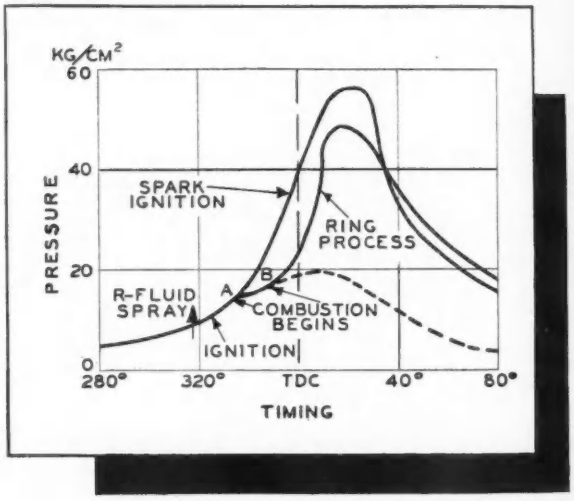


Fig. 2 — Influence of R-fluid injection on pressures.

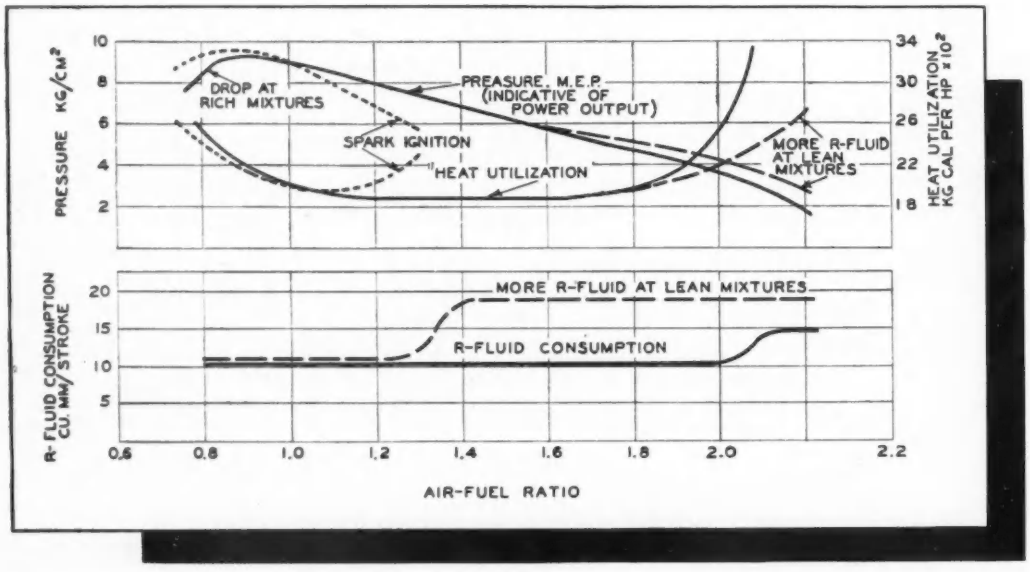


Fig. 1 — Comparison of efficiency of operation of an engine utilizing the ether ignition system and a standard spark ignition at varying air-fuel ratios. The lower chart gives the amount of ignition fluid used.

Ether as Ignition Agent

*By Lieut. R. J. Bender, USNR**

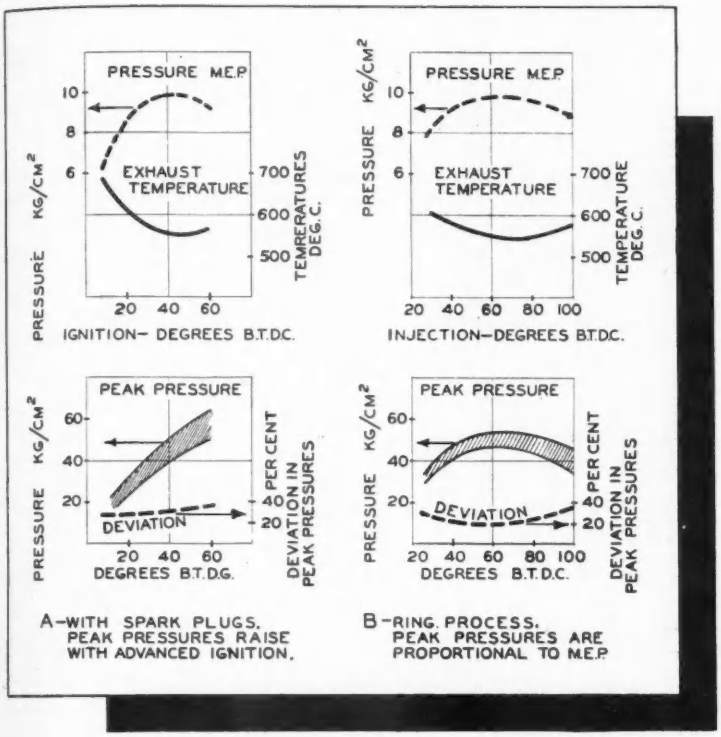


Fig. 3—Spark ignition and the Ring-Process mep and peak pressures compared at various ignition and R-fluid injection timing.

tion of very lean mixtures is a slight increase in the quantity of R-fluid. Fig. 1 illustrates the economy of the process when the air-fuel ratio is varied. As slightly more R-fluid is used for the lean mixtures, the power output curve is also slightly raised. On the other hand for very rich mixtures the ignition delay seems to increase resulting in a power reduction. In other words, as the temperature of self-ignition of the R-fluid is not reached quite as fast for a rich mixture, a slight power-loss occurs. To obviate this, the injection timing of the gasoline is slightly advanced so as to permit the R-fluid particles to completely permeate the air-fuel mixture.

Knock

The Ring Process has proven to reduce to a considerable extent the knocking tendency of a fuel. This seems to be due to the fact that the particles of R-fluid penetrate thoroughly throughout the mass of air and fuel and, when they ignite, start the ignition uniformly. It is as if an infinitely large number of small spark plugs were all operating simultaneously.

Timing

The timing of the injection of R-fluid into the cylinder does not seem to have the same effect upon the operation of the engine as the timing of the ignition has upon a spark plug engine. This is explained in Fig. 2 on the theory that, as soon as the spark is produced ignition takes place and the rate of pressure rise is modified when the timing of the spark is changed. On the other hand the injection of the R-fluid does not instantaneously start ignition; ignition does not take place until near top dead center. In other words a slight change in the timing of the injection of R-fluid does not affect the rate of pressure rise. A sudden rise in the pressure curve occurs at point A as soon as the spark is produced, in the spark-ignition engine while it does not occur until point B, for the Ring Process, regardless of the exact timing of the R-fluid injection. Point B of the curve corresponds to the pressure and consequently temperature condition at which self-ignition of the R-fluid

* Prepared for Combined Intelligence Objectives Committee, G-2 Division, SHAEF. Information in this report was obtained from Dr. Fritz Penzig, I. G. Farben Industrie, and Dr. K. Peter, Bayerische Motoren Werke.

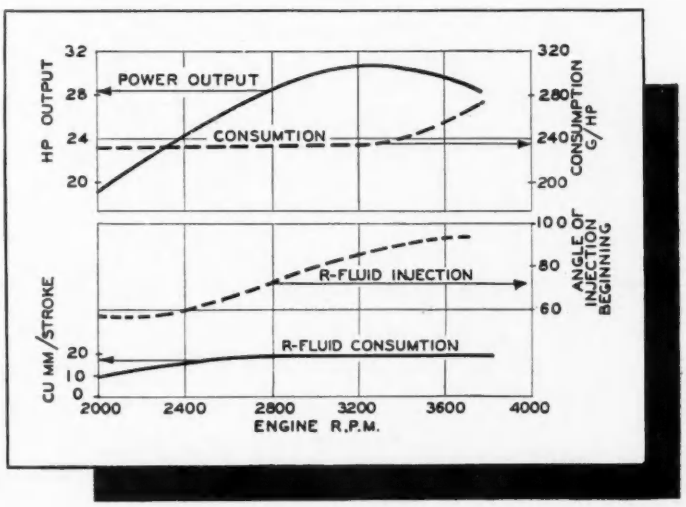


Fig. 4—Influence of engine speed on the consumption of R-fluid.

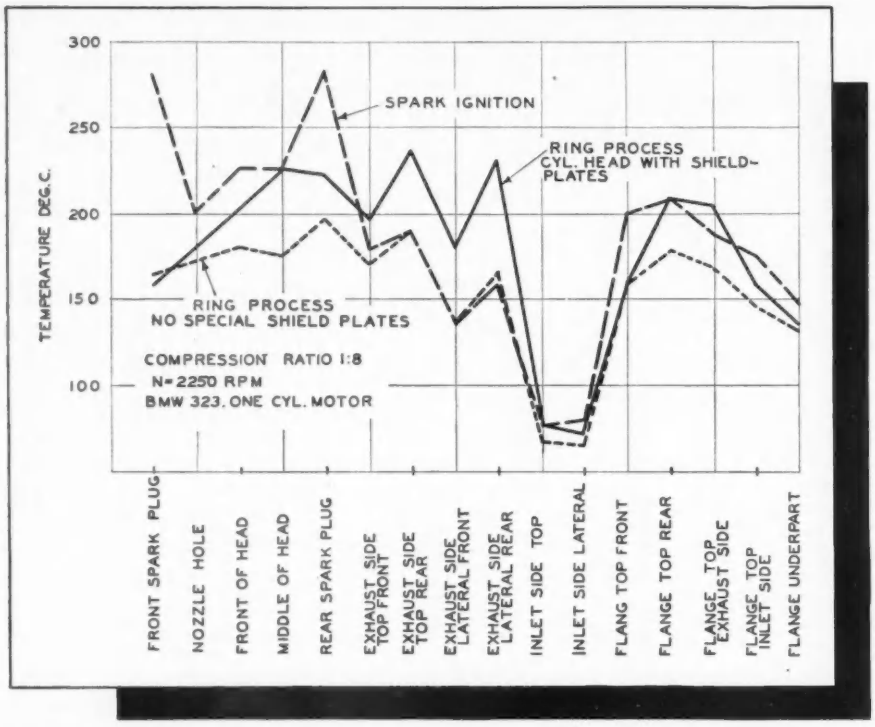


Fig. 5—Comparison of engine temperatures encountered during Ring-Process ignition with temperatures recorded during spark ignition operation.

occurs. A comparison of the various pressures noted in the spark-ignition process and in the Ring Process, when varying ignition or R-fluid injection timing, is shown on Fig. 3. Examination of the curves shows that, while the maximum mep indicative of maximum output of power is the same in both processes, peak pressures are different. In the Ring Process, mep and peak pressures are correlated, and independent from the timing.

Engine Temperatures

Tests run with air-cooled engines as well as with liquid-cooled engines have demonstrated that the cylinder head temperatures were considerably lower with the Ring Process. In a liquid-cooled engine the heat carried away by the coolant was 15 to 25 per cent lower with the Ring Process than with spark-plug ignition, at full load. Further tests were planned, but not completed, to determine how this difference in heat loss may be accounted for, particularly since the exhaust gases did not show an increased heat loss of equal amount.

Engine Speed

Tests conducted at the Hirth Motor Co. in Stuttgart Zuffenhausen proved that no difficulties in the injection of R-fluid need occur at any rate of speed. Speeds as high as 3800 rpm were reached. The results of these tests are shown on Fig. 4. Curves show that the timing of R-fluid injection must be slightly advanced at high speeds, as may well be expected, and that the fuel consumption expressed in grams per horsepower increases also with increasing speed, which is normal. A regular Diesel injection pump with a 6 m/m plunger will take care of the usual rate of R-fluid injection, which varies from 10 to 20 cu mm per stroke.

Flight Tests with the Ring-Process

Prior to the flight tests described below, preliminary tests were made on one cylinder of a 9-cylinder radial engine, the BMW 323, having a 3 liter cylinder capacity. An R-fluid injection nozzle was installed in place of the spark plug, and the compression ratio was raised from 6.4 to 1 to 8 to 1. No knocking was noticed with the various fuels used. Aviation gasoline C3 was selected for test purposes. The only difficulties experienced were an increase in fuel consumption and some ignition failures when the temperature of the air from the supercharger was below 50 C. This led to a study of the engine temperatures as it was expected that at high altitudes excessive cooling would cause further failures of the process. Fig. 5 shows the temperatures at various places of this one cylinder engine. It also appeared advisable, in order to avoid ignition failures, to direct the spray of R-fluid against a real hot part of the combustion cham-

(*Turn to page* 74, *please*)

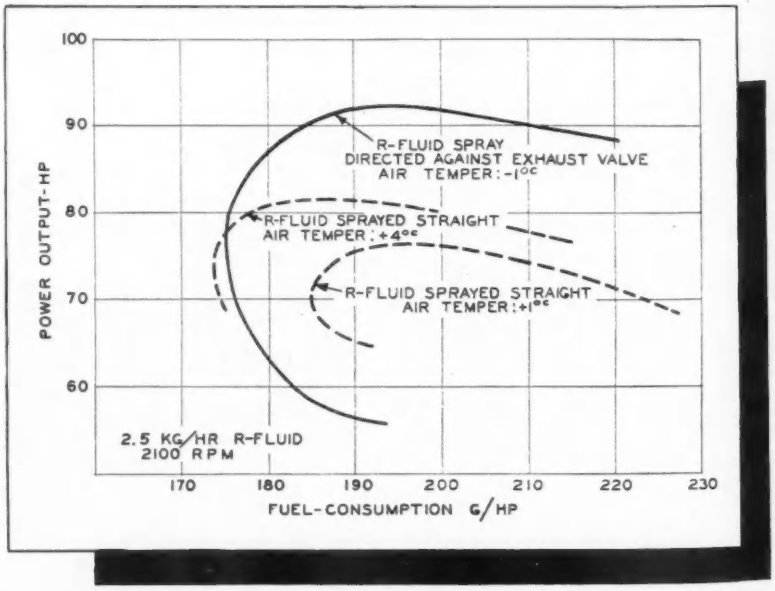
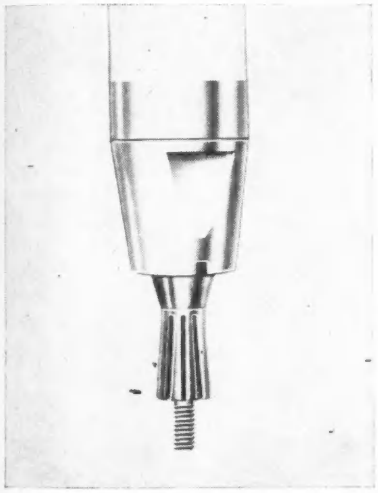


Fig. 6—Change in fuel consumption resulting from change of method of spraying the R-fluid into the cylinder.

New Production and Plant Equipment

JAMES INDUSTRIES, INC., Skaneateles, N. Y., have placed on the market the Jackson collet-type finder for electric and pneumatic screw drivers. This device starts and completely sets screws in a single operation.

The finder, which is attached to the screw driver, holds the screw firmly and works in any position and in places not easily accessible to other tools or to the fingers. One hand is left free for positioning work. The finder is non-rotating and close-fitting

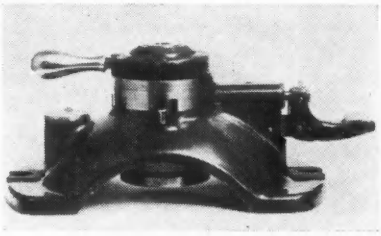


Jackson collet-type screw finder

to prevent the bit from whipping. The bit is guarded and no impression is left on the screw head or on the work surrounding the screw. Models are available for all standard types and sizes of machine and wood screws.

CONSTRUCTED to hold work for milling, grinding, drilling and shaper operations, a new collet indexing fixture made by G & H Manufacturing Co., 327 Elm St., Fitchburg, Mass., is claimed to be of special advantage where accuracy of work location and convenience of loading and unloading work are important factors.

Removable screw-insert stop buttons are used to block out unwanted indexing stations in a particular set-up. The index plates are likewise removable. A selected position is quickly introduced, or an undesired station blocked out of indexing sequence, by removing or inserting a screw in the indexing plate slot. A chip-clearance hole extends



G & H indexing fixture

through the entire depth of the fixture for the purpose of offering a ready exit for chips, and prevent them from clogging working parts in the fixture. The fixture's bottom section is of open construction, and this allows chips to be removed quickly, as they fall through onto the work table.

Collets commonly used in Brown & Sharpe automatics and wire feed screw machines are often specified for the G & H indexing fixture, but other types of draw-in and push-out collets can be used when desired, providing the fixture is equipped with the correct closing piece. The fixture can be positioned either horizontally or vertically on the machine work table with equal facility.

IMPROVEMENTS of its welding head designed to simplify production installation setups and increase speed of operation, are announced for its "Lincolnweld" hidden-arc process of automatic metallic shielded arc welding by the Lincoln Electric Co., Cleveland, Ohio. The new, improved head is designated as the "LAF-2."

To further expand its use on sheet metal work, the "LAF-2" has been designed to accommodate 3/32-in electrodes. The head is shipped with the same lower wire contact jaws as the previous head designated as "LAF-1" which accommodates electrode wire ranging from ⅛ in. to 7/32 in., but an extra movable tapered contact jaw is supplied which can be quickly interchanged if 3/32-in. wire is desired.

The controls of the "LAF-2" have been modified to simplify arc starting. Now all that is required to start the arc is to turn a single control switch to the "Down Weld" position. This causes the electrode to feed down until the end touches the work piece. Short-circuiting the wire to the plate automatically causes the wire feed motor to stop. The flux valve is then turned on and the arc started by means of a push button. The arc is extinguished and the electrode is withdrawn by moving the operating switch from "Down Weld" to the "Up" position.

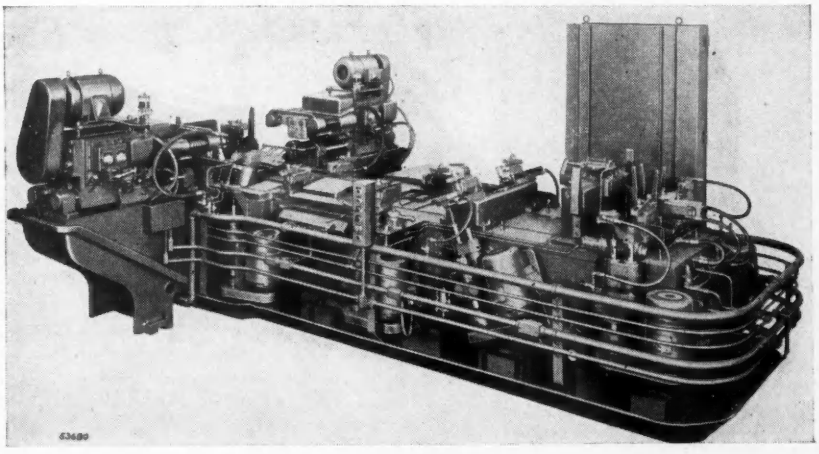
Another innovation is the use of plugs and receptacles which reduce installation time for the "LAF-2" head. Two receptables are mounted in the automatic control box and plugs are attached to one end of the cable coming from the welder supply and one end of the cable coming from the head itself.

A new, simplified wire straightener has also been added which makes it easier to insert the starting end of the wire and effect more positive wire straightening.

SNYDER TOOL & ENGINEERING CO., 3400 E. Lafayette, Detroit 7, Mich., has designed and built a machine for drilling a series of holes for mounting bodies, motors and spring suspensions in automobile frames.

This machine accommodates three different size frames, adjustment to longer or shorter frames being made by moving the entire clamping bracket as well as the spindles, and positioning in correct location for the individual frame.

Frames are located on equalizing



Snyder machine for drilling holes in automobile frames

clamps and are positioned and clamped by means of air cylinders and cam clamps. The sides of the frame near the front end are drilled with multiple heads driven from Snyder standard self-contained hydraulic units.

The vertical and angular spindles are driven from individual motors and are fed through the work by one hydraulic cylinder which actuates action pinions. This cylinder and feed mechanism is mounted on the inside of the welded steel base.

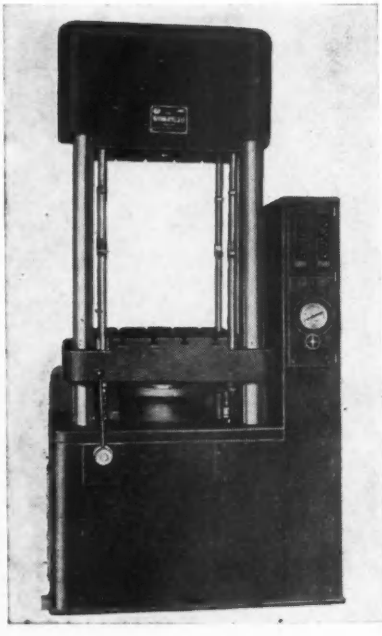
The design of the machine provides piping for coolant, air and electric wiring on the outside of the machine for easy accessibility, and to serve as a guard rail for the operators.

The manufacturer states that the changeover from one size frame to another can be made in very short time, giving this machine ready adaptability and eliminating the need for individual machines for each size frame.

WATSON-STILLMAN CO., 109 Aldene Rd., Roselle, N. J., offers a new semi-automatic molding press of 100-ton capacity, identified as machine No. 9379. The unit is suitable for either compression or transfer molding. Degassing control by time rather than limit switches is a feature which allows a complete range of die opening and ready adjustability.

The press is arranged and machined for attachment of a top transfer cylinder, which is optional equipment. This cylinder, with the addition of a plate to connect the ram to the ejector bars, can also be used as a top hydraulic ejector cylinder.

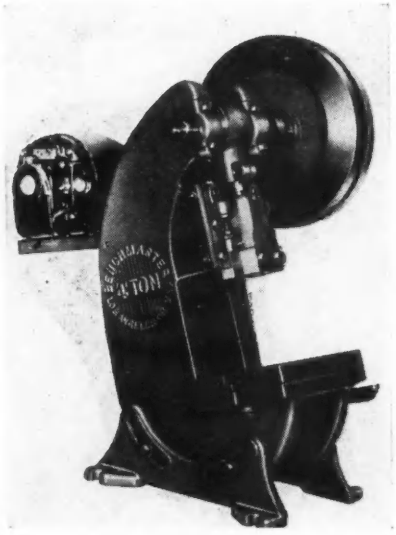
Die space of the new 100-ton semi-automatic molding press is 20 in. by 21 in. Stroke is 12 in. The operating pressure is 2200 psi. Speeds are: Advance, 260 in. per min; pressing 13.5 in. per min; return, 220.0 in. per min.



Watson-Stillman molding press

Capacity of top cylinder is 25 tons, and the unit is powered by a 5 hp motor. Power unit included pump, valve and controls. Tank and motor are housed in base of machine behind a removable cover. Pump is radial-piston type with built-in short stroke control. Power unit can be steplessly adjusted to within 25 per cent of the total tonnage of the press.

AN improved four-ton bench punch press is now being produced by the Benchmaster Manufacturing Co. of Los Angeles, Calif. Weighing only 215 lb, the press operates at a speed of 285 rpm with a 1725 rpm electric motor. Its features include a precision-ground shaft that is keyed by means of a press fit to a large eccentric. An over-size bronze bushing en-



Benchmaster punch press

closes the eccentric, and full diameter bronze bushings encase the shaft at wear points. The frames are cast in one piece from semi-steel, heat-treated and reinforced at stress points, and are mounted on two supports forming a broad stand cradle which allows the machine to be inclined for greater versatility in operation. An open back makes it possible for work to be inserted from the front as well as from the sides. A new type floating motor mount maintains proper tension of the V-belt drive.

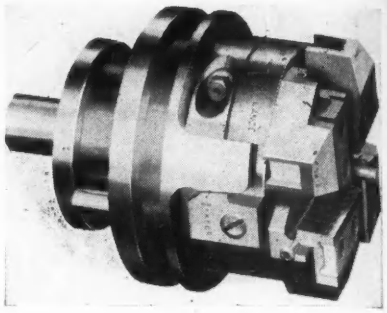
When ram is in up-position, a 5¾ in. die space is available. The fly wheel has a weight of approximately 50 lb.

•

LANDIS MACHINE CO., Waynesboro, Pa., has developed a 9/16 in. Lanco taper attachment die head having a capacity of ⅛ in to ½ in. standard pipe threads.

The die head is of the rotary type and adaptable to any machine having either a leadscrew or lead cam. It can be furnished with special shank and flange required for adapting it to different machines.

Tapered threads are generated with



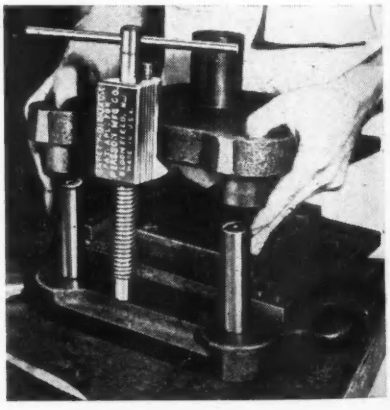
Lanco taper attachment die head

the die head the same as straight threads in that they are formed with the chaser throat. This eliminates chaser leave-off marks when the die head opens.

A NEW hand tool, just introduced by the Thread Miller Corp. of West Orange, N. J., is claimed to permit threading and tapping at high speeds in a lathe with safety to tools and operator. This tool, known as the Grip-Slide threading and tapping tool, eliminates projecting tap or die holder handles, and can be used for cutting either right or left hand threads.

An advantage claimed for the device is that it eliminates the necessity for moving the tailstock back and forth when threading or tapping work in the lathe, thus preventing drag on the thread being cut. Sliding movement of the die or tap holder takes place on a hardened and ground guide bar concentrically true with the tapered

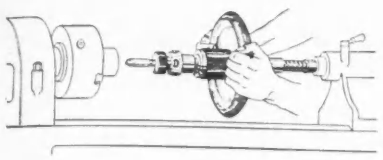
Safety Die Jack



The Persson safety die jack, made by Persson Manufacturing Co., 2 Henry St., Bloomfield, N. J., is designed to enable a single operator to elevate a punch holder to any height required, and to lower it in a safe manner. The clamp block of the jack is one piece, made of heat-treated aluminum alloy. All other parts are steel. The Persson jack is said to be particularly valuable when lowering punch sets. Positive adjustment of the jack screw permits the punch set to be stopped at any desired height.

shank that fits into the tailstock spindle.

The die or tap holder also is a hardened and ground piece having the bore for the guide bar concentric with the recess in which the die or tap is held. Thus the tap or die is in alignment with work that is held in the chuck of the lathe. The die or tap holder is a precision sliding fit on the guide



Grip-Slide tool

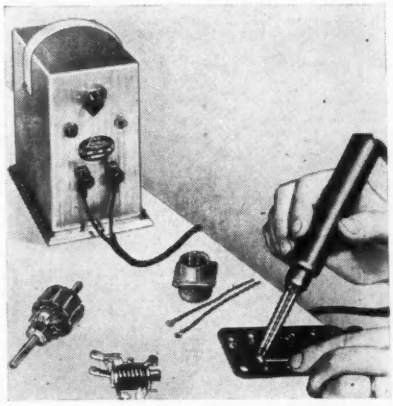
bar, and the guide bar is ring marked at quarter-inch intervals for accurate duplication of thread length on parts. An Ettco chuck is furnished which provides a positive drive by gripping the square on the end of the tap in addition to securely holding the tap shank.

The Grip-Slide tool is furnished in two sizes—the "Regular" for use in bench and small engine lathes, and the "Giant" for use in larger lathes. The "Giant" model has a wheel type grip and the "Regular" has a knurled gripping surface.

A CONTINUOUS salt bath furnace with automatic quenching mechanism, designed for cyanide hardening the ends of control levers has been completed by the Bellevue Industrial Furnace Co., 2971 Bellevue Ave. Detroit 7, Mich. With minor changes, the furnace could be used for hardening almost any type of parts, including use with baskets. The ferris-wheel type automatic loader, located at the charging end of the furnace is equipped with metal pockets for holding the specially designed fixtures carrying this particular part. These loading pockets are spaced and are synchronized so as to allow the fixture holding the parts to be placed in the slots provided on the continuous chain. The chain travels the entire length of the machine which includes furnace and quench tank. As the fixture is placed on the chain, the work is carried through the salt and the entire length of the furnace. Reaching the discharge end of the furnace, a rotary arm operating automatically, and synchronizing with the speed of the chain, picks up the fixture containing the work and drops it into the quench tank.

The machine can be provided with oil, water or hot salt quench tanks. An unloading mechanism, similar to the loading device described, synchronized to the chain and discharging the fixtures on a conveyor, can be provided. A variable control drive is supplied to permit the changing of the time cycle for parts going through the furnace.

LUMA ELECTRIC EQUIPMENT CO., Toledo 1, Ohio, presents a resistance-type soldering tool in four power ranges. Two single and two multi-stage units are offered, with a choice of eight basic single or double carbon electrodes. The single-stage tools have

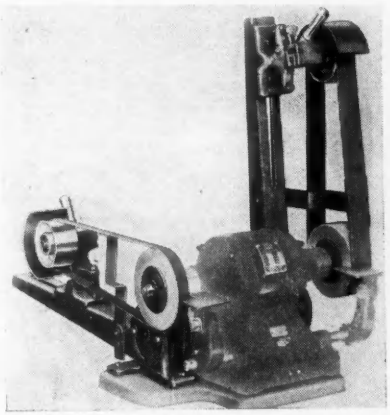


Luma resistance-type soldering tool

a power range of 1050 to 1225 watts—the multi-stage units from 1575 to 2500 watts.

Electrodes are equipped with five-foot flexible cables, and come in sizes from 3/32 in. to ½ in. diameter. The 3/32 electrodes in both single and double types are especially suited to light work. Their weight, including cables, is only six oz. For heavier operations, the 5/32-in. single or double electrode is best suited. The ⅜-in. or ½-in. single carbon or roller type is recommended, by the manufacturer, for spot soldering and work involving seams and large terminals.

PORTER-CABLE MACHINE Co., 1800 N. Salina St., Syracuse, N. Y., is manufacturing a light, narrow-belt grinder attachment, type N-2, capable

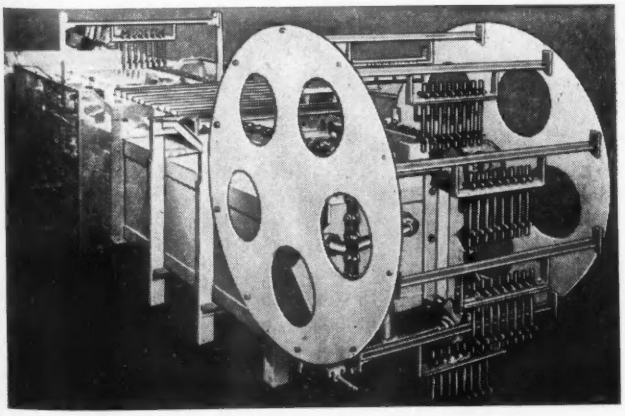


Porter-Cable narrow belt grinder attachment

of performing all kinds of light burring and grinding operations. Said to combine the versatility of platen grinding with the economy and speed of contact grinding, it is suitable for light grinding of flats, arcs, angles, gear burring, weld grinding, cleaning up operations, etc. A wide variety of composition and plastic materials, as well as steel, iron, aluminum, wood and glass are easily ground and surfaced.

The attachment is furnished without motor and is quickly aligned and attached to the familiar bench type wheel grinder, to which a resilient contact roll has been fitted.

The complete unit assembly stands 27 in. high with a width of 2½ in. A six-in. by seven-in. T-shape base is drilled with three holes for mounting to bench or work table. Platen size for flat grinding is two in. by four in. Resillent contact rolls two in. by six in. or one in. by six in. can be furnished. Using an endless abrasive belt two in. by 48 in. the attachment can be used either in the vertical, horizontal or any position (angle) between the 90 deg.



Bellevue salt bath furnace

AUTOMATIC pull-up and automatic gaging in lengths from ⅛ in. to 48 in. are made possible through the development by Peerless Machine Co., Racine, Wis., of a mechanically-controlled power saw.

Metal is fed forward within a four-sided saw-frame assembly which completely surrounds the work as the metal is being cut. When the cut is completed, the conveyor feeds the predetermined length of metal into the

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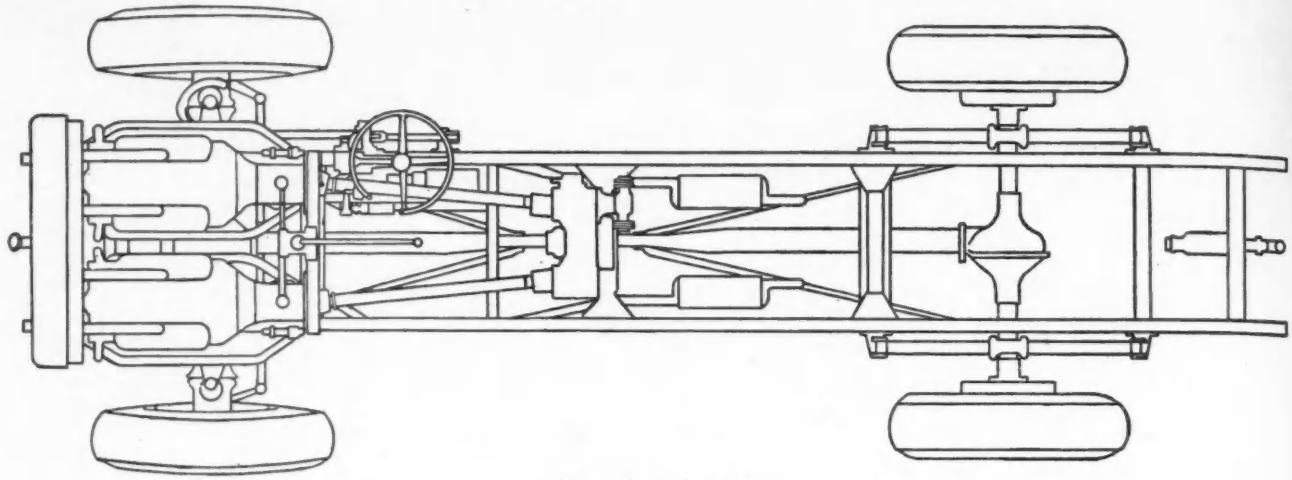


Plan view of truck.

British Truck Has

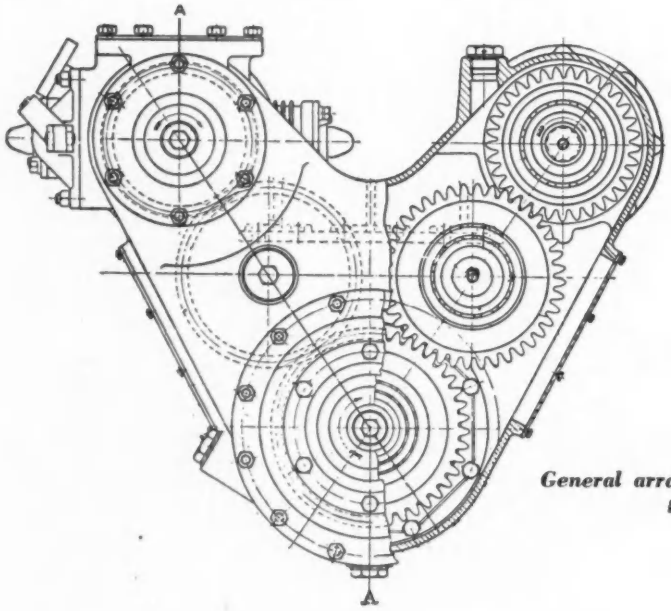
Ingenious Twin-Engined Drive

TO MEET requirements for power greater than normally required either for exceptional loads or to provide improved performance, the British magazine *The Automobile Engineer* describes an installation using two standard engines of normal size in place of one unit specially designed for the purpose.

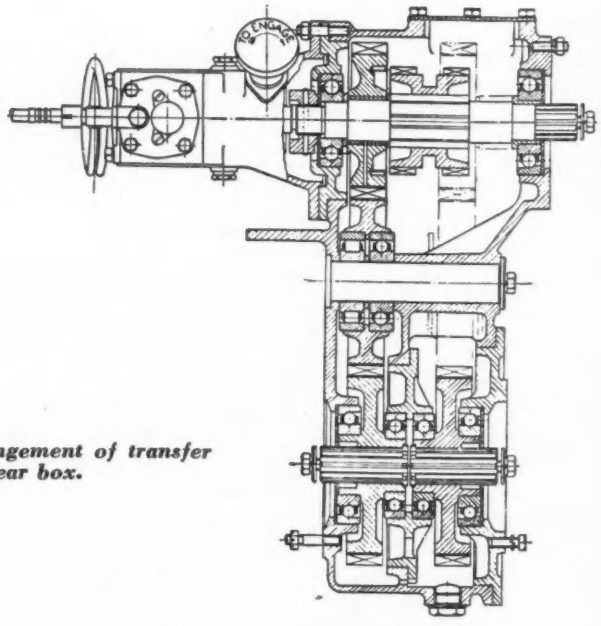
In the Garner-Straussler twin-engined truck, economies in cost are effected by the wide use of standard Ford truck parts. These include two standard V-8 engines with clutches and transmissions and two standard rear axles complete with torque tubes. One of the rear axles is modified by the fitting of steering swivels and constant-velocity universal-joint drive for the front wheels, the standard rear hubs being used at the front also.

Both clutches are controlled by a single pedal, synchronization being ensured by hydraulic operation. An ingenious mechanism provides for gear changing in both transmissions by means of one lever yet either transmission may be left in neutral and its engine stopped if desired. By keeping the two transmission systems entirely separate, the possibility of one axle having to transmit most of the power from both engines is avoided.

Though combined in one casing the transfer gears are entirely separate, the right side engine driving the rear axle and the left side engine the front axle. Provision is made for driving a winch and a tire pump from the right side engine only. The power units are mounted as close together as the clearance necessary for removal of the inner cylinder heads will permit. Each engine has its own belt-driven fan and radiator; the header tanks are connected by a pipe and have a common filler.



General arrangement of transfer gear box.

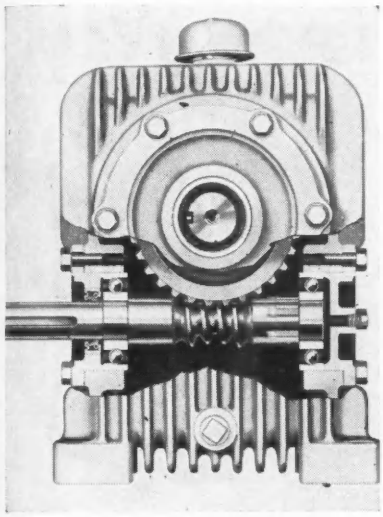


SECTION AA.

New Products

Standardized Cone-Drive Speed Reducers

A complete standardized line of compact speed reducers, built around double enveloping Cone-Drive gearing has been brought out by Michigan Tool Co., 7171 E. Nicholas Rd., Detroit 12, Mich.



Cut-away view of Cone-Drive speed reducer

Cone-Drive gearing has more teeth in contact and more contact per tooth than any other type of right angle reduction gearing and as a result, smaller gears can be used to transmit a given load, resulting in more compact housings.

The new standardized line includes models with pinion under, pinion over, and with gear shaft vertical. The center distances of from two to 18 in. cover a power-transmission range up to 800 hp input to the pinion. In the smaller sizes, models light enough to be carried in one hand are designed for fractional horsepower work.

Standardized Cone-Drive gear sets and standardized Cone-Drive pinion and gear mountings are used in all models. Assemblies are either right or left hand. Available ratios range from 5:1 to 70:1. Extended pinion and gear shaft models also are available. All parts for any model of a given size are interchangeable.

The new Cone-Drive reducers are said to be the first complete line of speed reducers with cooling fins on every model. All of the new standard Cone-Drive reducers, from 4 to 18 in. center distance inclusive, can be equipped with water cooling coils to provide increased thermal capacity where required.

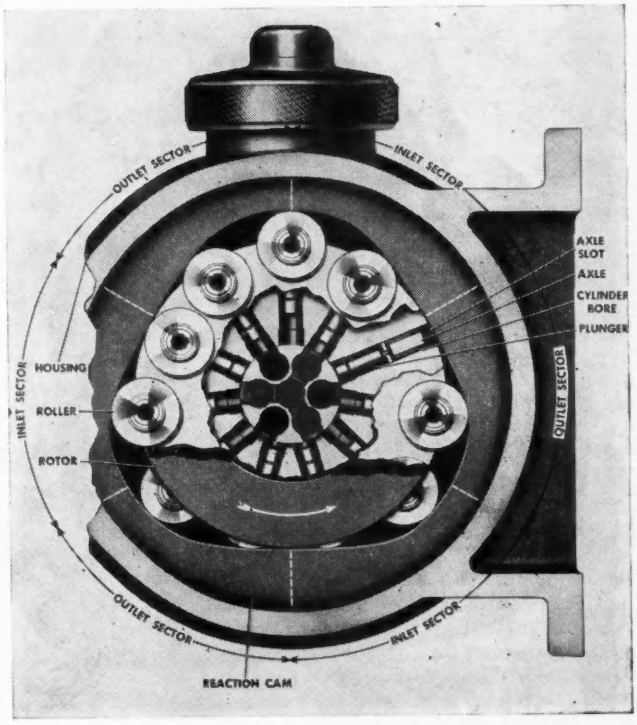
The finned housings are all of the box type, resulting in a large oil capacity both for lubrication and for heat conduction. Splash type oiling is used on all the standard reducers.

Industrial-Type Hydraulic Motor

Production of a new type of industrial hydraulic motor, combining high starting torque with smooth power, is now under way at Superdraulic Corp., Dearborn, Mich. This development, known as the Superdraulic Triport motor, parallels the Superdraulic line of high pressure hydraulic pumps, making available a balanced combination of pumps and motors, each designed to insure efficient operation when combined as a complete power transmission system.

The 47-hp motor is only 10½ in. in diameter and light enough to be easily handled by one man. Torque range is as high as 200 lb-ft. The motor is available in two types, one rated at 26½ gpm with 3,500 psi input at 1,200 rpm the other at 19 gpm with 5,000 psi at 1,200 rpm.

This newly-announced motor is said to hold many advantages for industrial machine applications, including infinitely variable speed control, forward and reverse, by means of a finger volume control valve, starting without clutches, and perfect control of acceleration and deceleration. Because of its design, which provides 66 power strokes per revolution, the motor is said to have turbine smoothness.



Sectional view of Superdraulic Triport motor

General Electric Develops Protective Plastic

A plastic material which can be shrunk over the ends of tubing, threaded pipes and precision machine surfaces to serve as a protective covering during shipping, storage, plating, painting and fabricating operations has been developed by the General Electric plastics divisions.

Made of tough, durable, highly moisture and chemical resistant material, the covering prevents the entry of possible contaminants into tubing and the damaging of threads.

Available in the form of caps, sleeves and tubing, this specially formulated material can be swollen by allowing it to remain in the G-E dilator for from three to four hours prior to use. Because the caps, sleeves and tubing swell to 50 per cent over their normal diameter, they can be easily

and rapidly applied on an assembly line. The plastic is tough, even when in the swollen state, and no splitting occurs when applying.

Direct contact with water or with common solvents, or acids encountered in painting, plating and degreasing operations, has no effect on the plastic material. Equipment, with caps and sleeves in place, has been baked for three to four hours at 300 F. without failure. The plastic material is said to be an excellent electrical insulation.

Heavy-Duty Torque Wrench

A new T-handle, heavy-duty torque wrench has just been added to the line of JO torque wrenches made by the JO Manufacturing Co., South Gate, Calif. The new JOTE has a range to 90 lb-ft, and is equipped with needle bearings to eliminate friction. As in the case of all the JO Line torque wrenches, the JOTE break comes by automatic impulse when the predetermined torque has been reached. All the torque control parts are metal encased to stand up under shop usage. The wrench is 10 in. long over all, 3½ in. high, has a ½-in. square drive, and is chrome plated.

Jote torque wrench

Like the smaller JOTE wrench, it is pre-set at the factory or in the tool crib. At present it is being manufactured with just the non-ratcheting action.

Adjustable Tappet with Self-Locking Screw

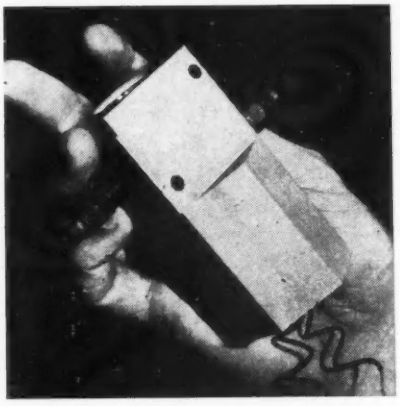
Johnson Products, Inc., Muskegon, is producing the Johnson adjustable "Lock-Tyte" tappet featuring the Johnson self-locking tappet screw. This tappet is available in barrel or mushroom types in all steel construction, all iron, or a combination of steel body with chilled iron face.

The lock is obtained by a diaphragm spring action which is said to be unaffected by the load, temperature or vibration. With no leading edges, the screw is not self-tapping and it maintains its effectiveness through any number of adjustments. The entire load is carried by the solid portion of the screw, the threads of which are fully seated at all times.

Solenoid-Operated Two-Way Valve

A new solenoid-operated two-way valve is now being produced by Electrol, Inc., 85 Grand St., Kingston, N. Y.

The electrol solenoid two-way valve weighs only 1¼ lb and measures 3 9/16 in. long by 1¾ in. hexagan. The housing, made of aluminum alloy bar stock anodized, has two ⅛-in. NPT female ports and two mounting holes for attachment in operating position.



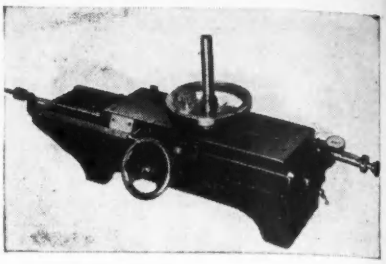
Electrol solenoid two-way valve

The device accommodates flows up to two gpm and the pressure range is from a fraction of a psi up to 1500 psi. Two four-in. flexible lead wires are provided on the standard valve, but longer lead wires can be provided for certain installations. A 12-24 volt direct current is required to energize the continuous duty solenoid, which also is of Electrol design and manufacture.

Parkson Gear Testers in Two New Models

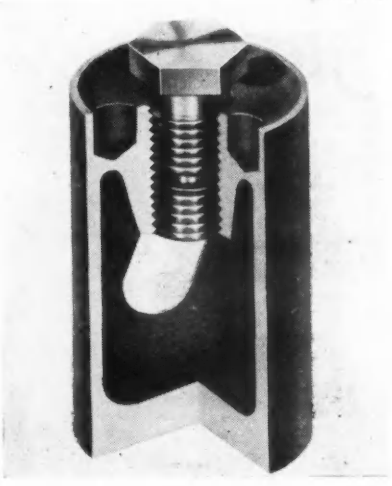
The George Scherr Co., 200 Lafayette St., New York 12, N. Y., offers two new models of Parkson gear testers. Both have a maximum capacity of 15 in. center distance.

One of the new models is equipped with a box-shaped upright which carries an adjustable bracket with means for clamping it in any desired position. This arrangement provides vertical centers for holding gears or pinions that are cut integral with their shafts or mounted on arbors.



Parkson gear tester for internal gears

The other new model has been especially designed for testing internal gears, either against the mating pinion or against a master. Whenever external gears are tested, the measuring pressure, in the floating slide which contacts with the dial gage, is toward the mating gear. However, when testing internal gears, the pressure has to be in the opposite direction. Therefore, the internal model incorporates an arrangement, whereby the pressure can be reversed at will. In this way both internal as well as external gears may be inspected for center distance, run-out, tooth thickness, and rolling action.



Johnson Lock-Tyte tappet

Texaco Announces Postwar Motor Oil

A new motor oil has been announced by The Texas Co., 135 E. 42nd St., New York, N. Y. Designed to prevent the formation of engine deposits of sludge and varnish, the new oil—to be sold under the Havoline trademark—keeps automobile engines clean and gradually removes accumulated deposits in dirty engines.

The lubricant is made from paraffin base crudes plus metallo-organic and organic additive compounds, completely soluble in the oil. It is also designed to prevent oxidation and the formation of corrosive acids. It is clean burning, heat resistant and clings to the bearings under all operating temperatures and pressures. By keeping rings free, the oil maintains maximum seal between cylinder walls and pistons and thereby allows the engine and fuel to perform at their maximum.

All-Purpose Grinding Wheel

The DoALL Co., 1301 Washington Ave., So., Minneapolis, has just introduced the new DoALL all-purpose grinding wheel.

The DoALL wheel is said to grind any kind of material—hardened alloy tool steel, annealed steel, stainless, Monel, bronze, aluminum, brass, and hard plastics—and to work equally

well for heavy fast roughing cuts and fine finishing. It produces a finish comparable to that of a 300 grit wheel. The new wheel can be used on all types of grinding machines—surface grinders, centerless, cylindrical, tool grinders, pedestal. No alteration to the machine is necessary and the cutting rate is limited only by the ability of the grinding machine.

The bond used in making these wheels is insoluble and prevents them from weakening from use of coolants in wet grinding. On the other hand, the open structure is such that the work remains cool even when dry grinding.

Recording Dilatometer

An improved automatic dilatometer for continuous recording of the thermal expansion and contraction of a wide range of materials including metals, glass, ceramics and plastics, has been announced by the Electronics Division, Sylvania Electric Products, Inc., 500 Fifth Avenue, New York, N. Y.

The equipment is designed to provide continuous graphic recording of the 12-hour expansion and contraction

Dilatometer made by Sylvania Electric Products, Inc.

cycles of samples. It records automatically without the supervision of a laboratory assistant.

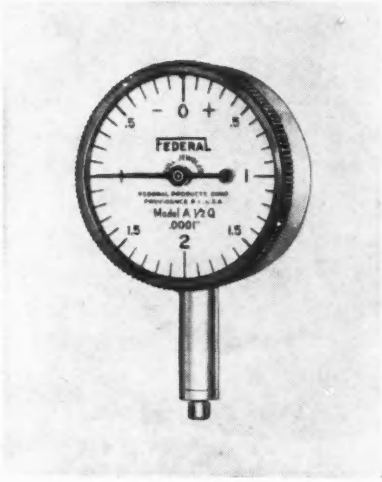
The dilatometer includes a furnace or sub-zero cooling chamber, furnace thermocouple, concentric quartz tube, specimen thermocouple, gearbox and support, transmission, contact mechanism, electronic relay, and recorder. Each one of these principal units performs a separate function, but all functions are closely coordinated to hold specimen temperature uniform within 1 deg. C., and to provide uniform heating and cooling with the specimen in an inert atmosphere, automatic shut-off, and an overall accuracy of 0.2 per cent.

Accommodating three, four or five-inch specimens, the dilatometer will accommodate temperatures up to 1000 deg. C. It is designed for use at 110-120 volts, 50-60 cycle supply and is rated at 900-1000 watts.

Federal Dial Indicators Available in Small Sizes

Three new "A" size dial indicators have been put on the market by Federal Products Corp., 1144 Eddy St., Providence, R. I. The overall bezel diameter of these new models is only 1¼ in.

These new Federal indicators are used where the design of a dial indicator gage may be such that there is not space enough for a large indicator, or where the gage is portable, and weight is a factor.



Federal "A" size dial indicator

An entirely new movement is built in these indicators which has the same low friction full-jeweled features as the regular Federal indicators.

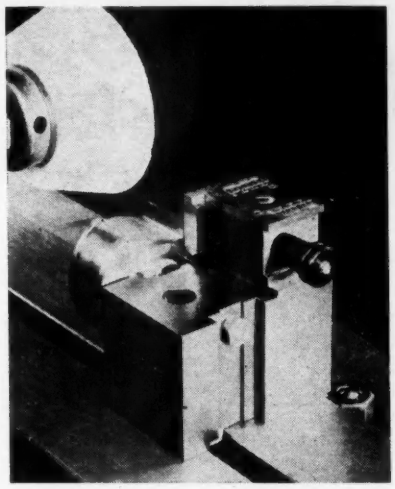
These indicators are designated as A½Q, A3Q, A6Q-2 respectively. Model A½Q is graduated 0.0001 in., Model A3Q is graduated 0.0005 in. and Model A6Q-2 0.001 in. They are regularly furnished with the American Gage Design Committee (A.G.D.) bracket back, or with post or flat type. Special backs also are available. The indicator dials can be rotated to set the zero.

Sharpening Fixture for Circular Form Tools

A sharpening and checking fixture for circular form tools used on screw machines and turret lathes has been added to the line of Hardinge Brothers, Inc., 1934 Anderson St., Elmira, N. Y.

The Hardinge sharpening and checking fixture may be applied to the table of any standard tool grinder. Circular form tools for either right or left hand cutting, having plain, octagon, serrated, ratchet or pin type hubs can be sharpened on this fixture. Circular form tools are applied to the fixture, the tool sharpened and the sharpening checked wtihout removing the tool from the fixture or tool grinder.

Circular form tools which fall within the following sizes can be sharpened on the fixture: Smallest center hole in tool ¼ in.; largest center hole in



Hardinge sharpening and checking fixture

tool 1 in.; maximum diameter of tool 3½ in.; maximum length of tool 2¼ in.; and maximum amount below center for cutting edge of tool 13/16 in.

Airco Extrusion Coated Self-Hardening Electrode

A new extrusion coated, self-hardening electrode is now available through authorized Air Reduction Sales Co., dealers from coast to coast. Manufacturered by the Stoody Co., this versatile electrode is said to have excellent arc characteristics, working equally as well with either an a-c or d-c machine. The new extruded coating is stronger, has less tendency to pick up moisture, presents a better appearance, and is completely uniform. Other advantages claimed for the new electrode are: No slag interference; more rapid deposition rate than dipped type electrodes; electrodes can be applied in all positions: no loss of hardness or wear resistance on multiple layers; solid, dense deposits with an absolute minimum of porosity; satisfactory application within a wide range of amperages; easy slag removal while deposit is still red hot—slag is self-lifting when deposits cool; and any desired type of bead can be applied including stringers, figure eights, crescents, weaving beads, etc.

Kennametal Composition for Precision Boring

Kennametal Inc., 1 Lloyd Ave., Latrobe, Pa., has developed a very hard Kennametal composition, Grade K5H, specifically for small tools used in precision boring of steel parts. It has a Rockwell A hardness of 93.2, great resistance to cratering (high content of tungsten-titanium carbide), and is said to be unusually strong for such a hard material. Solid tools 3/32 in. to 5/16 in. diameter, and 5/32 in. to 5/16 in. square, are available, as well as blanks 3/32 in. to ⅜ in. diameter and 3/16 in. to ⅜ in. square suitable for grinding to any desired tool point shape.

NEWS *of the* Industry

Allocation of Steel and Iron to Building and Farm Equipment Industries Contributes to Shortage of these Metals . . . Strikes Reduce August Production . . . No Prospect of Normal Output in Immediate Future . . . New Wage Drives Expected . . . Production Low Despite High Employment Levels . . . Location for Plant Based on Manpower Survey . . . National Organization of Used Car Dealers Planned.

Automobile manufacturers are deeply concerned over the effect of CPA directions 12 and 13 of Order M-21, which allocate distribution of steel, merchant pig iron, and iron castings to the housing and farm equipment industries. In effect, the directions give producers of specified items in these two industries a preferential position in relation to the limited available supply of these scarce commodities. Of the two orders, the one dealing with pig iron and castings is the more troublesome, since the available supply is even more out of balance than is the case with steel.

The present shortage of scrap contributes greatly to the bad situation in pig iron and steel. Normally a good supply of this material comes from the breaking up of old cars and other machinery. However, with millions of old cars still running far past the age when they normally would have been junked, this source is negligible today. Also, the concentrated scrap drives conducted during the war have pretty well cleaned up most of the old junk lying around on farms and in other places, so these sources have practically dried up. Another factor in the shortage of pig iron is that OPA pricing made production unprofitable, with the result that many furnaces are not operating. Some price adjustments have been made but they still are not considered high enough by many marginal producers to warrant re-opening furnaces. The shortage of scrap also has a double effect on the pig iron deficiency. If not enough scrap is available to charge steel furnaces, the only recourse is to use scarce pig iron, which further reduces the available supply. Some companies have even gone so far as to make direct trades with steel mills, whereby scrap from the plants is allocated to the mill in exchange for steel, although this practice is not widespread.

The allocation of castings has a direct effect on the automobile industry, which has no priority rating under M-21. Foundries are required to fill certified orders granted under direction 13. Only after these orders have been taken care of can the remaining supply be distributed "in a fair and equitable manner." The result has been that the automotive companies have been forced to scurry around to find what they can after priority orders have been filled. This, of course, requires shopping in a great many places, and some have gone as far away as Texas and Utah to buy pig iron for their own foundries at a heavy freight differential. The outlook for improvement in the near future is not very good, and may exert an important influence on production schedules the rest of this year, at least. A big help would be use by the building industry of vitreous soil pipe in place of cast iron. However, that would require revision of building codes, which is not a likely prospect.

August Production Hampered By Important Strikes

When official production reports for August are in, they undoubtedly will show a disappointing result in light of the high expectations at the outset of the month. Not only did supplier strikes increase in number, but the nature of the parts hit by stoppages was such that production was halted by at least two producers when alternate sources were not available and inventories were not high enough to carry on. Hudson, for example, was down the first 12 days of the month and Studebaker also did not operate for a few days. In addition, Packard suffered an eight-day suspension stemming from a dispute in its own plants. Other manufacturers lost some production here and there for a day or two at a time because of wildcat walkouts. Pontiac Div. of G. M. was closed when pickets threw a line around the plant to protest vacation pay allowances to veterans, which had been paid in accordance with provisions set up by the UAW-CIO itself. Dodge and Chrysler also were victims of unauthorized walkouts. While the number of men involved in each case was not large, the integrated nature of production halted assemblies, with the effect on total output all out of proportion to the issues, which could have been settled by resorting to established grievance procedures.

Heavy Production Schedules Still Many Months Away

Judging from opinions and published statements, automotive industry leaders do not expect anything like prewar volume of production for several months. In a report to stockholders, K. T. Keller, president of Chrysler, said that there appears to be no reasonable prospect in the immediate future to operate under what would be considered normal conditions. Ford spokesmen have said that there is little likelihood of increased production appreciably above present levels until late this year at the earliest. From published weekly reports of General Motors production, it is evident that production is increasing from week to week, but it generally is conceded that unless something unusual occurs in the labor and materials situation, production this year will not hit prewar levels. The best record in relation to prewar production to date are being made by two independents—Hudson and Nash. Both are operating at or above 1941 levels.

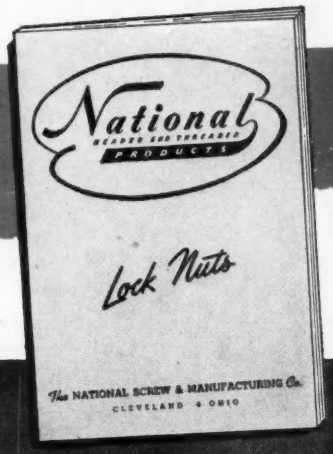
Wage Drives Appear Certain But Timing Is Undecided

In view of the position taken by the UAW-CIO at the recent meeting in Washington of CIO delegates on wages and prices, the automotive industry appears headed for wage trouble. Walter Reuther, UAW president, warned that automotive contracts would be reopened on wages whenever possible if living costs continue to rise. He followed his usual line of attack by charging that "middlemen, food monopolists, and profiteers" were responsible for higher prices. It is well recognized now in union circles that the wage increase won last spring have pretty well evaporated, and some of the more temperate leaders are urging that efforts be concentrated on increasing production and fighting rising prices. However, Reuther is undoubtedly on the hot seat, since his political balance of power is precarious, and he may be forced into another untenable position by the demand of Chrysler

(*Turn to page* 58, *please*)

Select the right lock nut

with this new help...



Whatever your lock nut problem, one of these 4 distinct types should be exactly right for your particular job:

National "Drake" Lock Nuts

Two-piece, positive lock, especially suitable for heavy-duty applications where unusually severe stress, shock or vibration is encountered.

National "Dynamic" Lock Nuts

Thin, shear nut with diaphragm lock, for applications where a thin, one-piece locking medium of light weight is necessary and where strains would be in shear only.

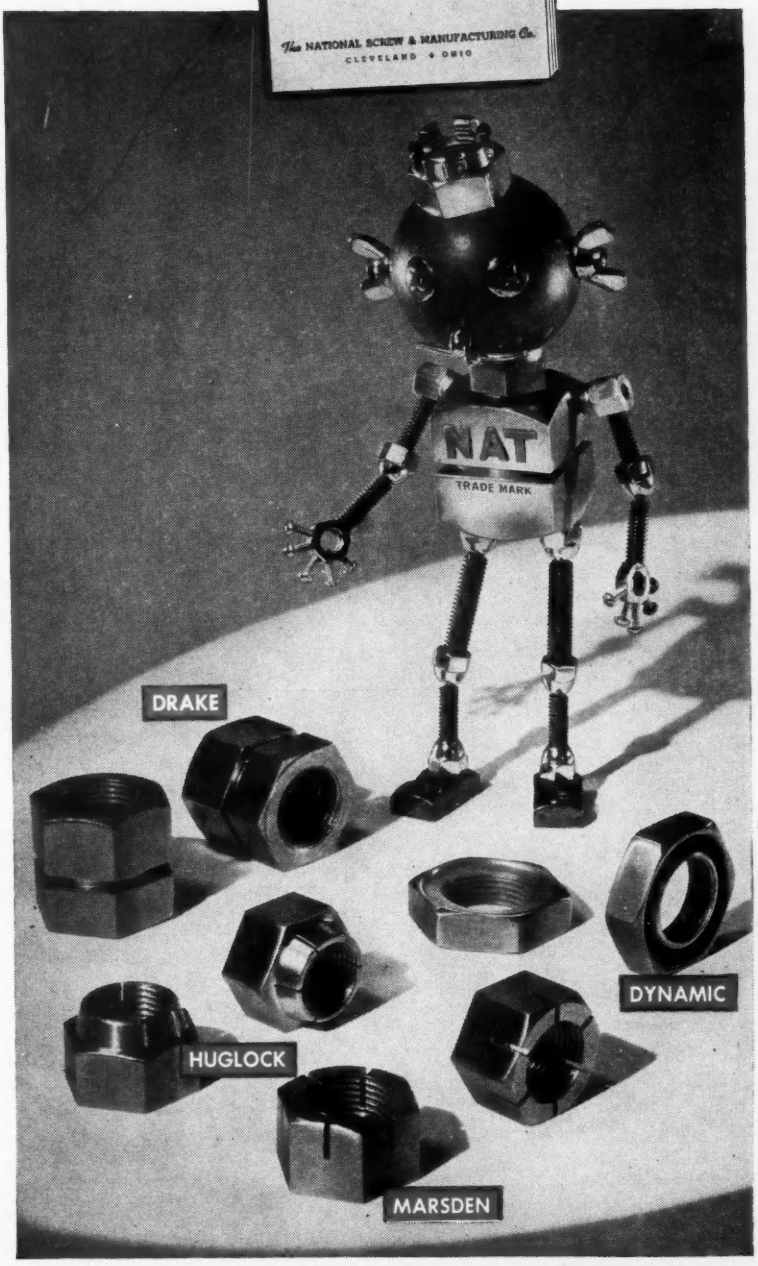
National "Huglock" Nuts

One-piece, all-metal lock nut—the self-locking pre-set torque values are built in and insure vibration-proof results on all applications, even where high temperatures, oil or other types of moisture are involved.

National "Marsden" Lock Nuts

One-piece, cantilever action type-designed for effective locking action with minimum cost. Easily applied, free running until seated.

May we send you complete information? A request on your letterhead will bring you the new Lock Nut Catalog, without any obligation. Please send for it today.



Other "National Screw" Specialties include:

- Clutch Head Screws
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- Phillips Recessed Screws
- Rosán Locking System
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National
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PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

Publications Available

Publications listed in this department are obtainable by subscribers through the Editorial Department of Automotive *and* Aviation Industries. In making requests give title above the item concerning the publication desired, the date of issue in which it appeared, your name and address, company connection and title.

Clamp Catalog

Marman Products Co., Inc.—New 20-page clamp catalog containing photographs, blueprint drawings and full construction details. A section is devoted to standard types, such as T-bolt clamps, quick-coupler clamps and multiple take-up clamps. Another section is included on clamps for special applications, such as straps, channel-band couplings, V-band couplings, manifold couplings, etc. Complete engineering drawings and tubular data for all standard Marman clamps are included.

Design Manual

New Departure Div. General Motors Corp.—A new design manual, the third book in a series of technical treatises on ball bearings for designers and engineers, covers enclosure and lubrication for all operating conditions. Parts one and two, of the series (also available), deal with principal bearing types and fundamentals of mounting practice, and describe details of shaft and housing designs important to good ball bearing performance.

Descaling Furnaces

The A. F. Holden Company—Brochure entitled Holden Furnaces for Sodium Hydride Descaling gives information covering the technical phases of the sodium hydride process developed by duPont for descaling, together with suggested types of equipment for use with this process.

Toggle Action Clamps

Knu-Vise, Inc.—A condensed compilation of its general catalog giving descriptions and diagrams of each classification of the models produced by the company.

Welding Manual on Aluminum

Reynolds Metals Co.—New 88-page book devoted to bringing users of aluminum a comprehensive resume of the latest practices and recommendations for joining aluminum by gas welding, arc welding, resistance welding, brazing and soldering. Book is available from Reynolds Metals Co., Dept. 47, 2500 S. 3rd Street, Louisville 1, Kentucky. Price $1.00 each.

Riveting Machines

The H. P. Townsend Mfg. Co.—6-page bulletin revised and brought up-to-date on riveting machines. Specifications, information on operation of machines and complete charts for ordering parts are included.

Monel and High Nickel Alloy Wire

Alloy Metal Wire Co.—A new catalog describes the properties and applications of Monel and high nickel alloy wire, rod and strip, for high temperature and corrosion resistance. Also included are engineering information on physical properties, electrical resistivity, heat treatment, magnetic properties, etc. Catalog number is D-2.

Beryllium Copper Wrought Alloys

The Beryllium Corp.—A new beryllium-copper handbook, prepared to provide data on The Beryllium Corp.'s wrought alloys and the commercial forms in which they are available and also to acquaint engineers with technical information on the physical properties, applications and methods of handling its products.

Garage Booklet

Oakite Products, Inc.—Newly revised booklet entitled Modern Oakite Cleaning Methods in the Automotive Service Field. Operations described are, cleaning cooling systems, car, truck, and bus body washing, steam-detergent cleaning, degreasing parts before repair and overhauling; paint stripping methods, etc.

Engine Controls

Synchro-Start Products, Inc.—Small booklet listing many of items made by

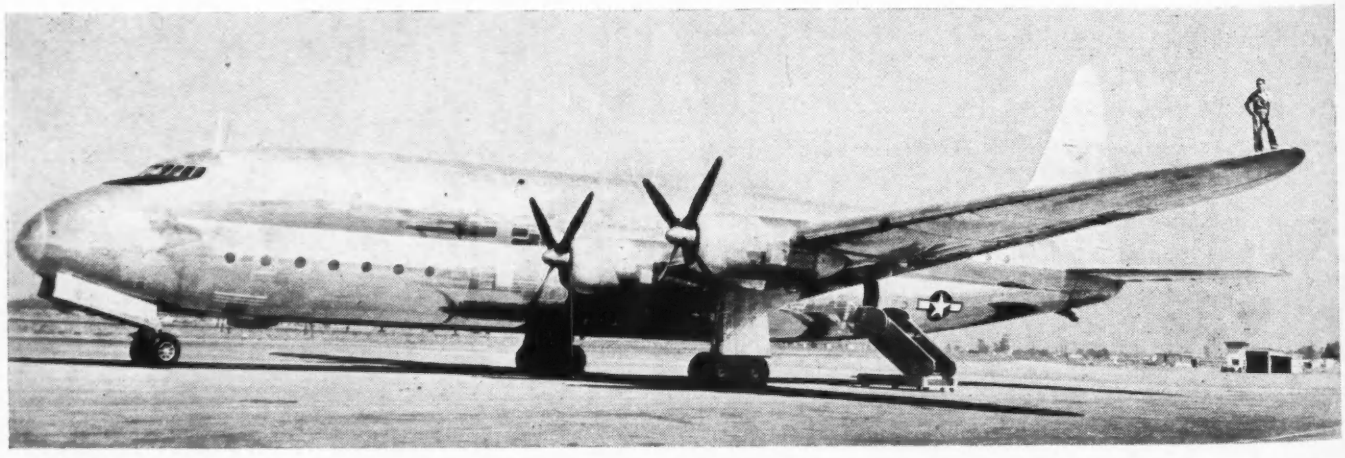
(*Turn to page* 56, *please*)

Increased Prices for All Automotive Parts

Increases in manufacturers' ceiling prices for all automotive parts over their base date freeze prices were announced Aug. 19 by the Office of Price Administration. The increases, all effective Aug. 24, 1946, follow: All automotive parts except those listed below, 15 per cent; dump bodies and hoists, 24.5 per cent; general purpose antifriction bearings, 12 per cent; fan belts, 17.3 per cent; radiator hose, 26.8 per cent; engine and engine parts, 15.5 per cent.

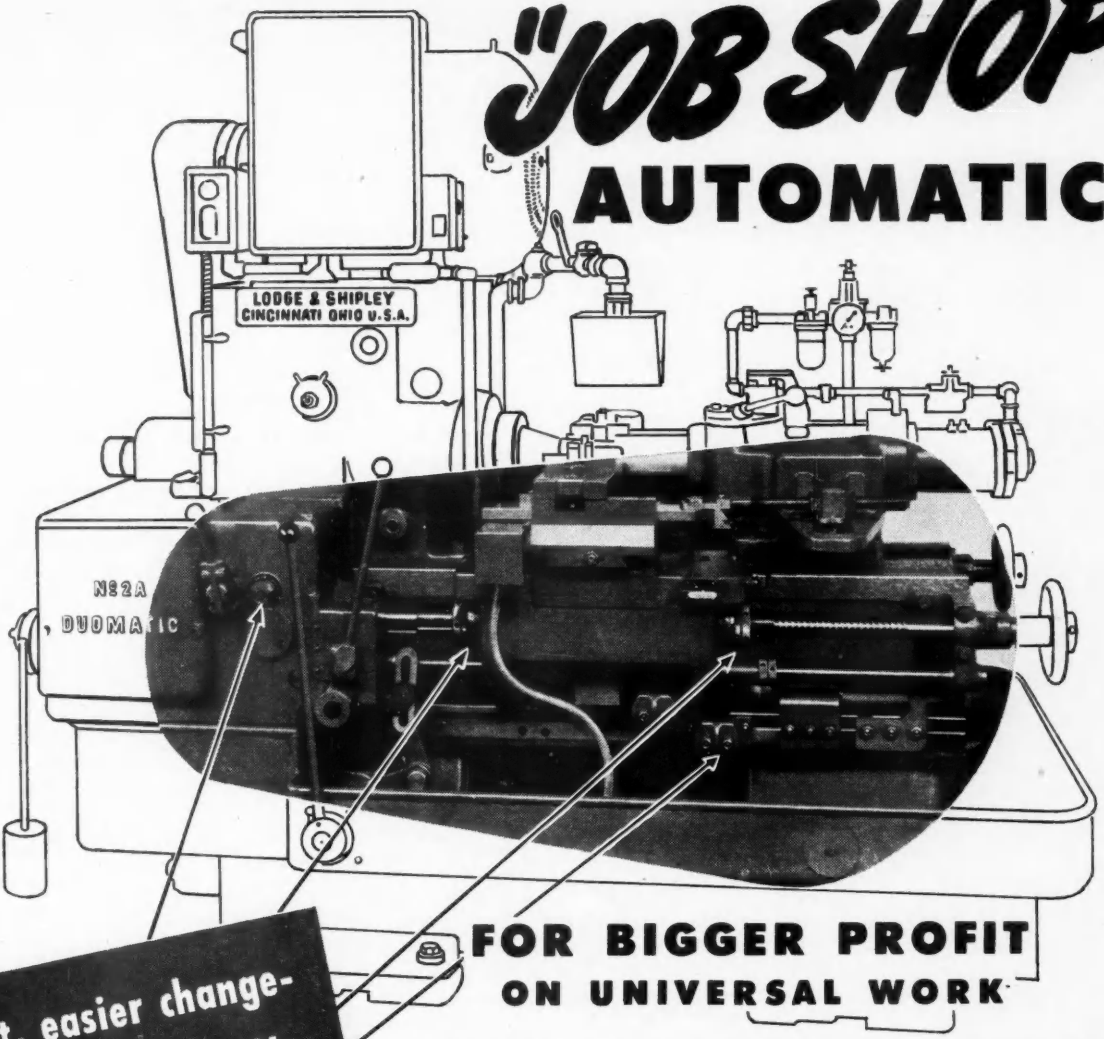
In addition to the price increases for manufacturers, OPA removed catalog houses and trade name resellers, who sell only standard parts which they buy from producers from coverage by the manufacturers' price schedule (Maximum Price Regulation 452), and placed them under the regulation covering distributors (Maximum Price Regulation 453). This change will enable these resellers to raise their maximum prices like other distributors sufficiently to cover acquisition costs and the discount or mark-up in effect March 31, 1946, for the distributive level in which they operate.

Navy's Largest Plane, the Lockheed Constitution



This 92-ton plane, with a capacity for 180 passengers, was designed to meet the Navy's need for a large, land-based transport with high speed and extreme range. Its characteristics include a wing design which will permit the introduction of gas turbine power for still greater speed and efficiency when this type of power is available. Known as the XR60, the new plane is powered by four Pratt & Whitney Wasp Major engines with a combined output of 12,000 hp. Useful load is almost 35 tons of passengers and cargo. Cargo space runs from 2000 cu ft with 168 passengers to 7405 cu ft when the entire lower deck is used for cargo. The cabin is pressurized to maintain a 10,000-ft altitude pressure at 25,000 ft. Wing span of the Constitution is 189 ft and its length is 156 ft.

"JOB SHOP" AUTOMATIC



FOR BIGGER PROFIT ON UNIVERSAL WORK

Fast, easier change-over on jobs . . . No Cams to change cycles, just make simple mechanical adjustments.

DO IT WITH A **DUOMATIC**

● Out in the plant they call it the "job shop automatic." Whether 50 or 5,000 pieces, you make more profit when you "Do it with a Duomatic". And you can even profit on change-over time. The Lodge & Shipley 2A and 3A Duomatics have no cams to change cycles—just make simple mechanical adjustments.

These newest of L & S Lathes transfer skill and responsibility from operator to the machine. It's like a lathe with a "man inside"—any unskilled operator can handle it. Fully automatic, front and rear tool slides, each with multiple tools, operate singly or together—perform a wide range and combination of turning, boring or facing cycles.

For detailed information on Duomatics, write on your company letterhead for Bulletins 601 and 620.

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L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

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PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Ford Motor Co.—**Harold S. White,** head of engine research; **J. M. McDonald,** Asst. District Mgr., Des Moines, Ia.

Kaiser-Frazer Corp. and Graham-Paige Motors—**J. W. Atkinson,** Asst. Director of Sales in Canada.

Chrysler Export Corp.—**Durwood L. Vorderman,** Sales Representative, Union of South Africa and Southwest Africa; **W. W. Sampson,** Sales Representative, Central West Africa and **W. K. Frentzel,** Sales Representative, Northern Brazil.

Pontiac Motor Div.—**Elmer J. Klebba,** Traffic Mgr.

Culver Aircraft Corp.—**Jack Steppe,** Asst. General Mgr.; **John M. Wright,** Chief Engineer.

Twin Coach Co.—**W. B. Fageol, Jr.,** Vice-Pres. and manager of company's newly created export division.

Hudson Motor Car Co.—**Roy D. Chapin, Jr.,** Regional Manager with headquarters in Detroit.

Norton Co.—**Michael Biscayart,** Regional Mgr. of Foreign Div.

Westinghouse Electric International Co.—**Douglas C. Lynch,** Asst. General Mgr.

Ohio Crankshaft Co., Tocco Induction Heating Div.—**Harry L. Keller,** head of Commercial Engineering Dept.; **Dr. Harry B. Osborn, Jr.,** Sales Mgr., Tocco Div.; **John T. Vaughn,** Research and Development Engineer; **A. H. Pittaway,** Laboratory Supt.; **John Gibbons,** Office Supervisor.

Gemmer Mfg. Co.—**Richard Flury,** Factory Manager.

The Budd Co.—**Warren H. Farr,** Vice-Pres. in charge of manufacturing.

Carnegie-Illinois Steel Corp.—**Robert C. Myers,** Asst. Mgr., Market Development Div.

Menasco Manufacturing Co.—**George C. Lentz,** Sales engineer for gas turbine engines.

Solar Aircraft Co.—**Samuel J. Zeigler,** Chief Engineer.

Industrial Rayon Corp.—**Hayden B. Kline,** elected to newly created post of Executive Vice-President and member of Executive Committee.

Packard Motor Car Co.—**E. P. J. Rigdon,** Regional Manager, Southwestern district; **H. R. Whitmore,** Zone Manager for Dallas.

Service Caster and Truck Corp.—**Edward C. Hamm,** elected President. Other officials are **A. Graham Reid,** Vice-Pres.; **L. L. Reed,** Vice-Pres. in chg. of Manufacturing and **Elmer C. Goodall,** Sec.-Treas. and Sales Mgr.

The Aro Equipment Corp.—**James E. Allen,** Executive Vice-President.

Redmond Co., Inc.—**Ralph Redmond,** Treasurer.

Pacific Airmotive Corp.—**Stan Wilson,** General Service Mgr. and **S. H. Grinnell,** Branch Mgr., Burbank.

Ethyl Corp.—Newly elected members of Board of Directors are, **Albert Bradley,** Executive Vice-Pres.; General Motors Corp.; **John H. Schafer, Percey L. Griffiths. Harry W. Kaley** and **Stanley T. Crossland,** all vice-presidents of Ethyl Corp.

The John S. Barnes Corp.—**E. C. Hawkins,** head of Chicago office.

Cardox Corp.—**Felix C. Rodgers,** General Mgr., Fire Div. and **H. V. Williamson,** Director of Research.

Lempco, Inc.—**Frank J. Schwab,** Vice-Pres., named head of sales activities of the company and all its subsidiaries. **Dan Anderson** has been made Sales Mgr. of Reamer, Brake and Clutch Div.; **George Russell,** Sales Mgr. of Engine Rebuilding Equipment Div. and **Al Harding,** Asst. Sales Mgr.

The Yale & Towne Mfg. Co., Stamford Div.—**Maurice D. Bennett,** Supt. of Research.

Stokerunit Corp., Simplex Machine Tools Div.—**A. F. Hasty,** Sales Mgr.

Detrex Corp.—**Dr. Wm. L. McCracken,** Adm. Asst. to **C. F. Dingley, Sr.,** Vice-Pres., in chg. of research and engineering.

Truck Prices Increased

Retail ceiling prices for Studebaker trucks and for Federal trucks have been raised by the Office of Price Administration an average of $77 and $96, respectively, effective Aug. 21, 1946, to comply with a requirement of the Price Control Extension Act of 1946.

The new maximum prices will increase Studebaker truck dealers' margins an average of 6.7 per cent and raise Federal truck dealers' margins an average of 5.4 per cent.

At the same time, ceiling prices for Indian motocycles were raised an average of $32 for the same reason. Dealers' margins will be increased by the action an average of 5.6 per cent.

Unionization of Foremen Upheld by Court

Unionization of foremen came one step closer to legal actuality in early August when the U. S. Circuit Court of Appeals at Cincinnati ruled against the Packard Motor Car Co. in a test suit against the NLRB, which had ordered the company to bargain collectively with its foremen. Packard contended the foremen are a part of management and therefore outside the scope of the Wagner Act. In its decision, the court conceded that foremen are the first line of management, but that they also are employees with reference to wages and working conditions and therefore entitled to bargain collectively on those issues with higher management. The court split 2-1 on the decision. The dissenting judge stated that foremen "are employers not only by reason of their duties and responsibilities, but by the inescapable implications of Section 152 of 2 of the National Labor Relations Act, which classifies an employer as one who is 'acting in the interest of an employer directly or indirectly.'" Packard is planning to petition the court for a rehearing of the case, and if this is denied to petition for a review before the U. S. Supreme Court.

Two New Buick Models Now in Production

Buick Motor Division of General Motors Corp. has begun production of two more 1946 model cars—a "personalized" convertible with push-button controls for top, windows and front seat, and a sedanet. Production of these 6-passenger cars on 124-in. and 129-in. wheelbase rounds out the Series 50 Super and Series 70 Roadmaster lines. Other body types already in production in these series are Models 51 and 71, 6-passenger, 4-door sedans, and Model 59, the 6-passenger Super Estate Wagon.

New Truck Registrations*

	May 1946	April 1946	May 1941	Five Months 1946	Five Months 1941	Per Cent Change	Per Cent of Total Five Months 1946	Per Cent of Total Five Months 1941
Ford	10,523	11,244	17,290	49,719	85,069	− 41.5	26.95	29.16
Dodge	10,171	8,339	6,012	36,479	26,041	+ 40.4	19.77	8.92
Chevrolet	17,217	6,404	22,332	30,666	97,461	− 68.5	16.61	33.40
International	6,008	4,245	9,023	24,532	41,093	− 40.2	13.29	14.09
Willys-Jeep	2,984	3,638	252	11,314	770	+1370.0	6.13	.26
Studebaker	2,142	1,348	434	5,275	1,754	+200.0	2.86	.60
G.M.C.	2,235	954	4,224	4,649	18,947	− 75.5	2.52	6.49
White	1,066	648	811	3,823	3,851	− 0.5	2.07	1.32
Mack	460	546	913	3,404	3,845	− 11.5	1.84	1.32
Reo	715	858	157	3,113	618	+404.0	1.69	.21
Diamond T	473	691	561	2,644	2,728	− 3.0	1.43	.93
Federal	466	315	156	1,671	661	+153.0	.91	.23
Autocar	337	320	228	1,624	1,021	+ 59.1	.88	.35
Brockway	341	311	244	1,503	931	+ 61.6	.81	.32
Divco	437	389	213	1,502	946	+ 59.0	.81	.32
Hudson	304	241	84	856	391	+119.0	.46	.13
Sterling	43	57	43	235	193	+ 21.8	.13	.07
F.W.D.	62	53	16	229	109	+110.0	.12	.04
Plymouth	1	1	1,066	5	4,743	.....	.....	1.63
All Others	300	318	128	1,337	618	+116.0	.72	.21
Total	56,285	40,920	64,187	184,580	291,790	−36.6	100.00	100.00

*—Data from R. L. Polk & Co.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

President Buckley of Bell Telephone Laboratories describes a television tube no bigger than a pocket flashlight.

get ready with CONE for tomorrow

The new building of the American Stone Company in St. Louis will have an electrically controlled car suspended from the roof for washing windows.

get ready with CONE for tomorrow

A plastic molding press weighing 17 lbs. and costing about $30 is offered by N. R. K. Manufacturing & Engineering Company of Chicago.

get ready with CONE for tomorrow

International Business Machines has a 6-key Braille typewriter and will give away the first thousand to blind veterans.

get ready with CONE for tomorrow

Du Pont has announced a new, improved translucent "metallic" lacquer for automobiles called "Metalli-Chrome"

get ready with CONE for tomorrow

Two former military pilots have established American Flyaway Service, at Dayton, Ohio, to deliver personal aircraft from manufacturers to dealers.

get ready with CONE for tomorrow

On its longest over-water run, Oakland to Honolulu, Naval Air Transport Service is landing its planes within 18 minutes of their schedule.

get ready with CONE for tomorrow

In the upholstery plant of Fisher Body, the annoyance and danger of static electricity was eliminated by humidification. An incidental benefit was reduced absence due to colds.

International Harvester is establishing a manufacturing research center with 350 men chosen from its plants all over the country.

get ready with CONE for tomorrow

Westinghouse has a bacteriacidal ultra-violet lamp to insert in milk cans that reduces bacteria count 96% in one minute.

get ready with CONE for tomorrow

The 6-mile canal dredged to supply the Dow magnesium plant at Velasco, Texas, with sea water is also serving as a freight artery.

get ready with CONE for tomorrow

Tucson Laundry Company has started twice-a-week laundry pick-up service by air over a distance of 60 miles.

"ENIAC", the electronic computor developed for the Ordnance Department, can do 100 man-hours of mathematical work in two hours. It is expected to revolutionize the mathematics of engineering.

get ready with CONE for tomorrow

American Optical Company has developed a sight-testing instrument which will make 14 vision tests in three minutes.

get ready with CONE for tomorrow

Beech Aircraft is developing a 6-passenger automobile with a 90-horsepower air-cooled engine that drives a generator powering separate electric motors on the wheels.

get ready with CONE for tomorrow

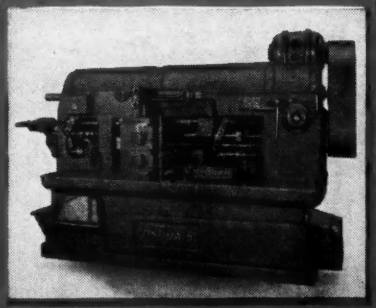
Martin Senour Company has developed a method of paint mixing that will produce 1000 tints with accuracy from 6 basic colors. The idea is being tested at a "paint bar" in a metropolitan department store.

COMPLETELY

PROFITABLY

The brass fitting illustrated is machined on a ⅞" 4-spindle Conomatic in 6 seconds. For machining parts completely and profitably, purchase Cones.

Ask your CONE *representative to show you our new color motion picture*



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

32

Truck-Trailer Prices Increased by OPA

The truck-trailer manufacturing industry was granted an 8.6 per cent ceiling price increase by the Office of Price Administration, effective Aug. 17, 1946, but declared the advance falls considerably short of wage and material cost increases.

"Generally speaking, truck-trailer prices up to now have been about at the level of 1942 despite sharply increased costs throughout the war period and since," said the Truck-Trailer Manufacturers Association. "First reports from individual manufacturers emphasize conviction that the OPA price relief is far from enough to offset steep expense boosts occasioned by the war and the failure of general reconversion to 'click' as rapidly as had been hoped."

Koppers Buys Additional Plant Facilities

Announcement that the additional facilities just acquired through purchase of the Defense Plant Corporation property and equipment adjacent to its American Hammered Piston Ring plant at Baltimore, Md., will be used for production of automotive piston rings has been made by the Koppers Company, Inc.

The additional plant facilities were purchased for $1,500,000 from the War Assets Administration and will give the company about three times its prewar capacity of industrial and automotive piston rings. Employment will be provided for 500 to 650 persons in the newly-acquired unit.

Publications

(*Continued from page* 52)

the company, including control sets, automatic cranking controls, panels, relays, governors, solenoids and switches. Each unit is briefly described.

Grinding Wheel Data Book

Simonds Abrasive Co.—New and revised edition of Grinding Wheel Data Book contains up-to-date information on grinding wheels and ginding practices. A Wheel Selection Table is included covering many recommended specifications for grinding a large variety of materials.

General Purpose Presses

Watson Stillman Co.—Bulletin No. 370-C, General Purpose Hydraulic Presses, contains specifications, explains the construction and work features, 20 to 200 ton capacities, designed to handle diversified metal working and plastic molding operations.

Aircraft Service Tools and Equipment

Airquipment Co.—New catalog covering many items of ground handling equipment and special tools for the aviation industry. Each item is pictorially described and applications, dimensions, load factors, weights and other pertinent data is completely presented.

Weekly Production of Cars and Trucks in U.S. and Canada*

Week ending	1946	Corresponding Week-in 1941
Jan. 5	13,920	76,690
12	23,340	115,935
19	28,465	124,025
26	29,410	121,948
Feb. 2	29,295	124,400
9	23,785	127,675
16	21,555	127,510
23	19,410	127,740
Mar. 2	17,575	126,550
9	23,050	125,915
16	35,020	131,410
23	37,285	123,805
30	43,070	124,165
Apr. 6	47,735	116,255
13	49,425	99,260
20	57,565	99,945
27	64,620	108,165
May 4	67,660	130,610
11	71,335	132,380
18	48,565	127,255
25	53,020	133,560
June 1	31,895	106,395
8	43,175	133,645
15	50,206	134,682
22	54,475	133,565
29	64,015	127,926
July 6	45,175	96,457
13	74,015	114,318
20	80,395	109,912
27	84,720	105,635
Aug. 3	79,385	62,146
10	77,825	41,795
16	88,990	45,550
23	91,620	45,525
Totals	1,628,416	3,735,274

*Compiled by Ward's Automotive Reports.

Advertising Note

Sutton News Service, Inc., has been engaged to conduct public relations for Bendix Helicopter, Inc., 50 Rockefeller Plaza, New York, N. Y. Roche, Williams & Cleary, Inc., of Chicago, will handle advertising, with Lloyd Maxwell, first vice-president, as account executive.

Aircraft Plant Employes in Reporting Plants, 1946*

Industry Classification	January	February	March	April	May
Total	227,521	213,388	206,250	207,699	206,712
Complete Aircraft	140,792	136,388	138,002	142,318	137,181
Aircraft Engines and Parts	44,842	35,507	30,604	33,234	33,324
Aircraft Propellers and Parts	5,293	5,315	5,695	6,196	6,383
Aircraft Instruments	10,215	10,703	10,140	8,261	6,980
Aircraft Parts and Equipment	26,379	25,345	21,809	17,660	22,844

* Source: Bureau of the Census, Facts for Industry, Series 50-3.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

General business activity has remained near the highest level indicated in the last twelve months. The *New York Times* index for the week ended Aug. 10 stands at 137.8, as compared with 137.9 for the preceding week and 137.5 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended Aug. 10 equaled 227 per cent of the 1935-39 average, as compared with 217 in the preceding week. Sales were 29 per cent above the corresponding distribution in 1945, as against a like advance of 30 per cent for the week before. The total in 1946 so far reported is 28 per cent greater than the comparable sum in 1945.

Electric power production was further increased during the week ended Aug. 10. The output was 0.4 per cent above the comparable amount last year. This excess over corresponding production in 1945 is the only one so far recorded.

Railway freight loadings during the same week totaled 899,084 cars, 0.1 per cent more than the figure for the week before and 3.3 per cent above the corresponding number a year ago.

Crude oil production in the week ended Aug. 10 averaged 4,821,450 barrels daily, 59,950 barrels less than the average for the preceding week and 112,600 barrels below the comparable figure in 1945.

Bituminous coal and lignite production during the week ended Aug. 3 was estimated at 12,255,000 tons, as compared with 12,500,000 tons in the week before and 11,214,000 tons a year ago. The output in 1946 so far reported is 17.2 per cent below the corresponding production in 1945.

Civil engineering construction volume reported for the week ended Aug. 15 by *Engineering News-Record*, $129,096,000, is 8 per cent more than the figure for the preceding week and 163 per cent above that recorded a year ago. The total shown for thirty-three weeks this year is 194 per cent more than the comparable sum in 1945. The increase in private construction is 480 per cent, and the advance in public construction is 67 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended Aug. 10 is 127.1 per cent of the 1926 average, as compared with 125.0 for the preceding week and 105.7 a year ago.

Member bank reserves declined $85,000,000 during the week ended Aug. 14. Underlying changes thus reflected include a rise of $104,000,000 in Reserve bank credit and a gain of $204,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a rise of $27,000,000 in money in circulation.

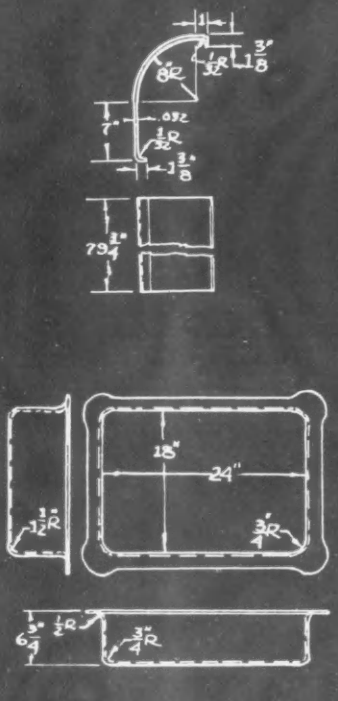
Total loans and investments of reporting member banks declined $876,000,000 during the week ended Aug. 7. A rise of $118,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $8,136,000,000, shows a net increase of $2,222,000,000 in twelve months.

Light Metals give your product new selling features!

COLGATE

DESIGNING • ENGINEERING • FABRICATING • ASSEMBLING

will get it to market *faster, better, economically!*

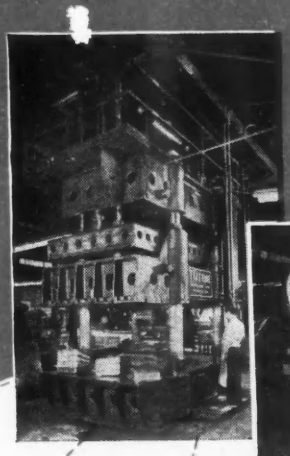


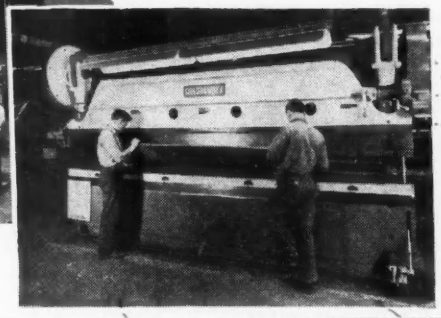
If the manufacture of your new or improved product has been interrupted by factors beyond your control, the urgency of getting it to market ahead of competition is of paramount importance. To secure immediate parts-production assistance and other benefits of sub-contracting service you will be interested in the comprehensive scope of COLGATE'S "Engineered Service."

This unique and unexcelled service offers immediate design, engineering, and production conferences that help develop your new product ideas or improve old products by substituting Aluminum, Magnesium, or Stainless Steel for other materials. Our cooperative collaboration of minds will save you time and money *before* designs have been started, also after blueprints have been prepared. COLGATE'S sales-minded designers and engineers will apply to your product these sales-building features of Aluminum, Magnesium, Stainless Steel—*lighter weight, added beauty, increased strength and durability, improved product performance, reduced shipping weight.*

COLGATE'S complete and varied tooling and production facilities can be your "branch factory" — providing ample space, supplying specialized skills and know-how, planning shortcuts for fast, economical fabrication and assembling of parts to precision tolerances, and in addition offer modern straight-line techniques that replace slower and costlier methods. And, COLGATE can be depended upon to meet delivery dates.

As the first step towards producing your product better and economically, and getting it to market faster call on COLGATE *now!* Learn how "Engineered Service" helps solve your production problems and gives your product the sales creating features of the light metals. For immediate action wire or write, no obligation, complete confidence assured.





STAMPING • FORMING • DRAWING • WELDING
FINISHING • ASSEMBLING

COLGATE'S complete and centralized facilities include Hydraulic presses ranging from 10 to 750 ton capacity, other mechanical presses from 2½ to 200 ton capacity.

COLGATE *Aircraft Corporation*

AMITYVILLE, LONG ISLAND . . . NEW YORK

LIGHT METALS PRODUCTS

CALENDAR

Conventions and Meetings

Natl. Aeronautic Assoc. of Canada, International Air Show, Toronto Aug. 30-Sept. 7
Natl. Chemical Exposition, Chicago Sept. 9-13
American Chemical Soc., Chicago Semi-Annual Mtg. Sept. 10-14
SAE Natl. Tractor Meeting, Milwaukee, Wis. Sept. 11-12
Natl. Assoc. of Foremen Convention, St. Louis Sept. 12-14
Instrument Society of America, 1st Natl. Show, Pittsburgh Sept. 16-20
Automotive Electric Assoc. Fall Meeting, Asheville, N. C. Sept. 22-25
SAE Natl. Aeronautic Mtg. & Aircraft Eng. Display, Los Angeles Oct. 3-5
Amer. Society Tool Engineers, Semi-Annual Convention, Pittsburgh Oct. 10-12
1946 Natl. Aviation Clinic, Oklahoma City Oct. 14-17
SAE Natl. Transportation and Maintenance Meeting, Chicago Oct. 16-17
Amer. Soc. Body Eng. Technical Meeting, Detroit Oct. 23-25
SAE Natl. Fuels & Lubricants Mtg., Tulsa Nov. 7-8
Natl. Aircraft Show, Cleveland Nov. 15-24
French Aero Show, Grand Palais, Paris Nov. 15-Dec. 1
American Welding Society Annual Meeting, Atlantic City Nov. 17-22
Natl. Metal Congress and Exposition Atlantic City Nov. 18-22
American Assoc. Motor Vehicles Adm., Annual Mtg., San Francisco Nov. 18-21
SAE Natl. Air Transport Engineering Mtg., Chicago Dec. 2-4
Natl. Standard Parts Assoc. Conv., Atlantic City Dec. 6-7
Motor & Equip. Wholesalers Assoc. Convention, Atlantic City Dec. 6
Automotive Service Industries Show, Atlantic City Dec. 9-14
Int. Aviation Celebration & Exhibition, El Paso Dec. 12-15
SAE Annual Mtg. & Eng. Display, Detroit Jan. 6-10

Bendix Helicopter, Inc. Starts Expansion Program

After more than a year during which hundreds of flights were made with its experimental helicopter, Bendix Helicopter, Inc., has started construction of a new 100,000-sq-ft factory building on a 30-acre tract at Stratford, Conn.

The plant is expected to be in operation next February. With the best utilization of the available area and using three shifts of workers, it will be capable of producing 200 contra-rotating four-seat helicopters per month.

The first Bendix helicopters will be relatively expensive and therefore first sales will be largely confined to commercial and government organizations.

News of the Industry

(*Continued from page* 50)

locals for a "cost of living bonus." In any event, since the Chrysler contract is the only one among the Big Three that can be reopened before next Spring, it now appears almost certain that when the big drive starts it will be against Chrysler. When it will come depends to some extent on how much higher living costs go and also on the Fall elections. Leaders are hoping to keep the membership in line until after election time in order not to hurt the chances of candidates friendly to unions. Also, the attitude of the government is dubious this time. Whereas, last Spring, the Administration actively aided and abetted the cause of higher wages, it now is frowning on further boosts and has indicated it will not allow further wage increases to be reflected in higher prices, which makes it almost impossible for a manufacturer to increase wage rates.

Employment Levels High Production Remains Low

Total number of employees at both General Motors and Chrysler today are above prewar levels, but production of cars and trucks is far below the number turned out in 1941. That situation highlights the troubles and scarcities the industry has been living with since V-J Day and accounts in large measure for the poor financial showings automobile producers have been able to make thus far. General Motors employment now has about 12,000 more workers than it had prewar in all its plants. Chrysler payrolls are up 2000 over 1941. With constant interruptions and low supply levels, it is impossible to attain anything like the production commensurate with present employment levels. While neither company will comment on worker efficiency, that factor undoubtedly has some bearing on the disproportionate relation between number of workers and total output over and above that charged to supply difficulties. While it admittedly is hard to determine worker productivity under present conditions of stop-and-go operations, studies made by several companies in departments which are on the same basis as before the war and which have the materials for uninterrupted production indicate that individual output is off from 20 to 30 per cent on the average. However, industry spokesmen are hopeful that the men will settle down this winter and really go to work. Absenteeism is particularly bad in recent weeks, especially among veterans, aggravating the already acute shortage of manpower being felt by the industry.

Manpower Survey Precedes New Plant Location

The problems faced today when planning for expanded facilities in a new location are typified by the experience of General Motors in deciding where to build a modern foundry for its new Central Foundry Division. The most desirable geographical location is in northwest Ohio, and accordingly the corporation has taken options on plant sites at both Tiffin and Defiance. However, with manpower a critical but unknown quantity, G. M. resorted to an intensive publicity campaign to find out which of the two locations would provide an adequate number of employees. Newspaper advertisements were run in areas surrounding both cities, laying the problem before the community and asking all persons interested in working at the foundry to sign up at designated times and places. At last reports Defiance was well in the lead with more than the 2000 persons required for operating the foundry signed up. Reports from both cities will be analyzed, however, and whichever offers the best manpower possibilities will be selected and the option in the other city will be allowed to lapse.

Used Car Dealers Plan For National Organization

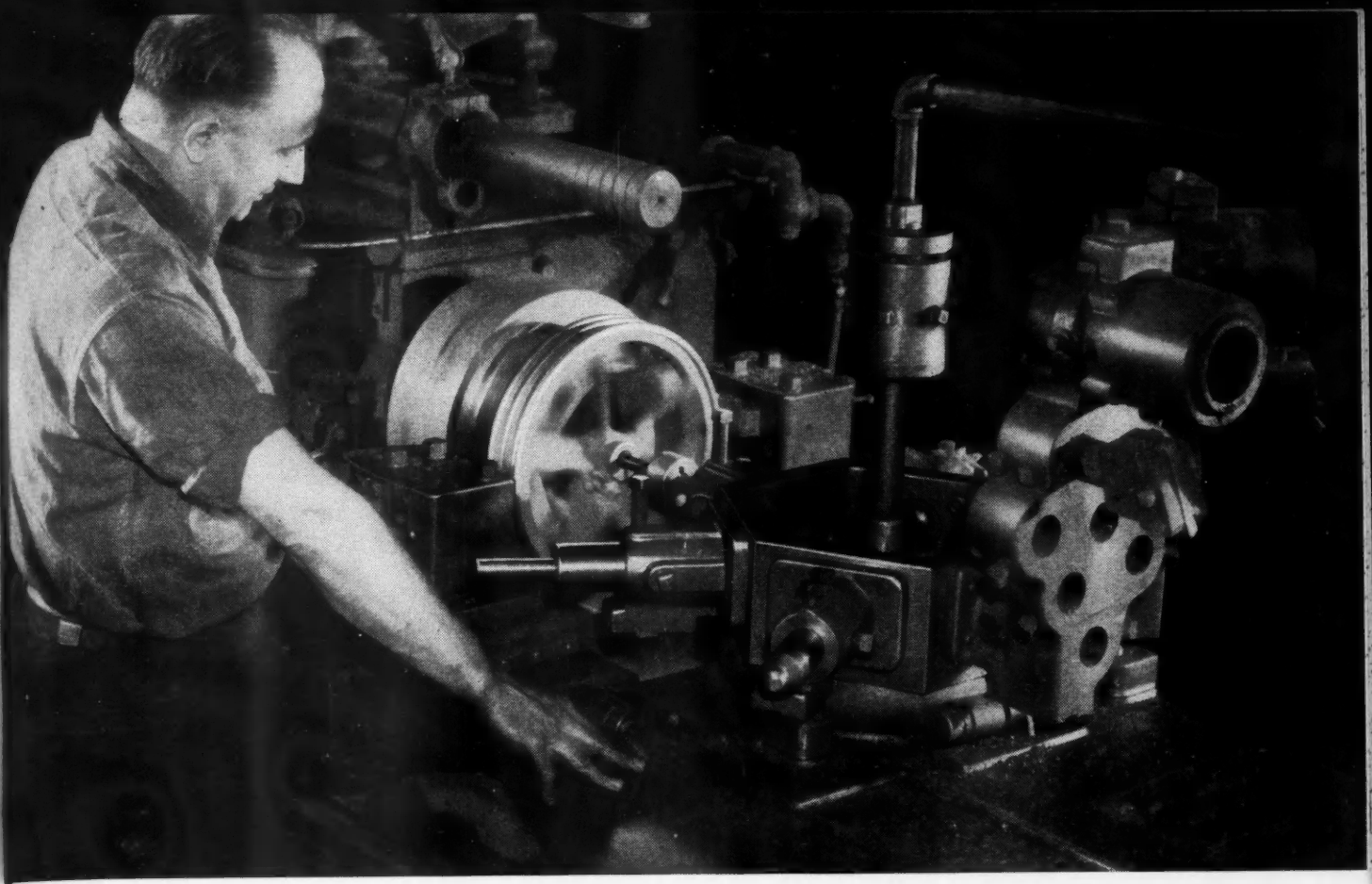
Apparently encouraged by the success of the National Automobile Dealers Association in exerting pressure on Congress to restore dealer discounts, the Michigan Used Car Dealers Association is attempting to unite used car dealers from other states into a national organization patterned after NADA. Meetings have been held in Detroit with representatives from other states, and details of the new body are expected soon. A principal first objective of the group will be elimination of OPA price ceilings on used cars as a means of whipping the black market.

Destination of U. S. Aircraft Exports*

January through April, 1946

Country of Destination	Aircraft Units	Aircraft Value thousands	Aircraft Shipping Weight Pounds in thousands	Engines Units	Engines Value thousands	Engines Shipping Weight Pounds in thousands
Total	462	$11,450	4,080	433	$2,674	685
North America	180	1,730	1,170	95	332	149
Central America	85	820	483	34	215	62
South America	108	2,718	1,383	129	459	154
Europe	36	3,748	633	135	1,190	224
Rest of World	53	2,434	411	40	478	96

* Source: Bureau of the Census, Report 410.



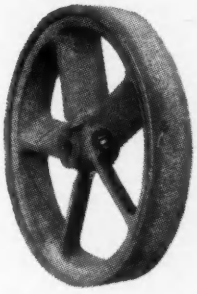
Production Trebled
when the *FASTERMATIC* took over!

Note the rather simple tooling arrangement for machining cast iron sheaves on this Fastermatic. The set-up, similar to regular turret lathe work, is made just as easily. But here, the machine performs 15 different operations—completes the entire machining job in 13 minutes. Former time was 39 minutes.

Completely Automatic Cycle

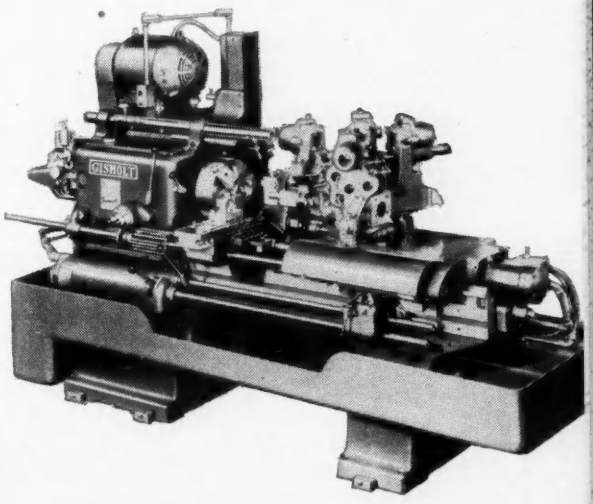
It's the swift, automatic cycle of the Fastermatic that accounts for such substantial time-savings. With its hydraulic feed system and automatic speed control, the operator has only to load the chuck, start the machine and remove the finished work. And usually, the operator has time to tend a second machine.

Now, when you need still greater production, is a good time to look into the Fastermatics. Ask for complete information.



Rough Casting

Finished Sheave



The Fastermatics *are universal automatic turret lathes. Designed for accurate, high production turning, they can also be economically used on comparatively small lot work. Write for literature.*

GISHOLT MACHINE COMPANY
1205 E. Washington Ave. • Madison 3, Wisconsin

Look Ahead...Keep Ahead...with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

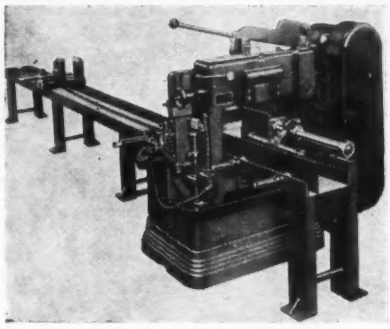
New Production Equipment

(*Continued from page* 45)

saw, the multiple bar-clamping vise releasing and setting automatically.

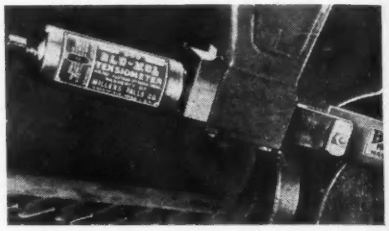
In case of accident or blade breakage, a micro-switch automatically stops the machine. When the last remaining stub of metal on the conveyor—single bar, a nest of bars, billets, tubes or squares—contacts the limit switch, the cycle automatically stops.

The new mechanically controlled conveyor is built for the Peerless Mechani-Cut model in 7-in. by 7-in. and 11-in. by 11-in. sizes. A 14-in. Mechani-Cut is supplied only with a manually-operated conveyor.



Peerless merchanically-controlled power saw

MILLERS FALLS CO., Greenfield, Mass., has recently developed a "Tensiometer" designed to set and maintain correct blade tension on power hack saws. It is a small cylinder enclosing a strong, calibrated spiral spring. It is attached to the blade holder of the machine and acts as a shock absorber for the blade, automatically compensating for changes of feed pressure, thermal expansion and contraction, and unusual shocks such as the blade striking a hard spot in the metal being cut. By controlling any desired tension from 0 to 4000 lb the "Tensiometer" is claimed to: Improve the accuracy of cut; maintain substantially constant tension in spite of lengthening of the blade due to heating and eye elongation; absorb shocks; minimize blade breakage; and increase the cutting life of the blade.

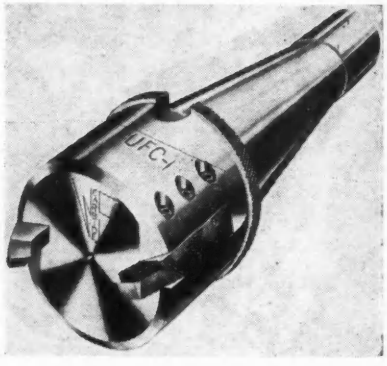


Millers Falls Tensiometer

A TWIN-UNIT, outdoor a-c arc welder in a single enclosure is now in production at the Electric Welding Division of the General Electric Co.,

(*Turn to page* 62, *please*)

Universal Fly Cutter



Long service life and ready adaptability are claimed for this universal fly cutter introduced by the Wendt-Sonis Co., Hannibal, Mo. The cutter does all kinds of ordinary and step milling operations on all types of materials. Only one cutter body is needed to handle 75 per cent of milling jobs, as the inserted teeth are easily interchangeable. Blades may be easily removed for sharpening on an ordinary bench grinder.

QUALITY IN TUTHILL SPRINGS NEVER TRAILS EVEN IN TRAILERS

HIGH QUALITY—LOW COST

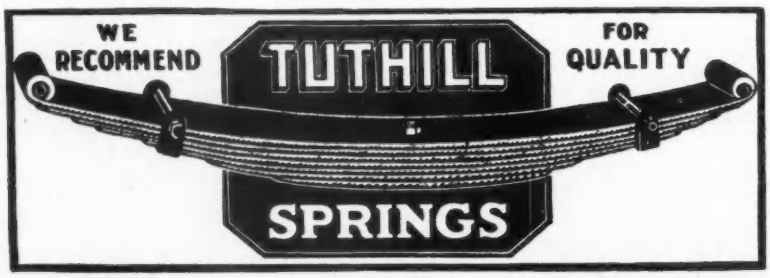
ALWAYS a step ahead in design, manufacture and performance, TUTHILL Springs never trail in quality. Proof of this fact is the BENHUR Trailer shown equipped with TUTHILL Alloy Steel Springs.

TUTHILL combines these features: 1. Quality materials scientifically inspected, tested and heat treated. 2. Efficient shock protection. 3. Absence of rods and torque arms. TUTHILL insures high quality at low cost. Strong, tough, resilient, Tuthill gives lasting service.

Tuthill makes a complete line of leaf springs, standard or special. What are your requirements?

TUTHILL SPRING CO.

760 W. POLK ST. CHICAGO 7, ILL.



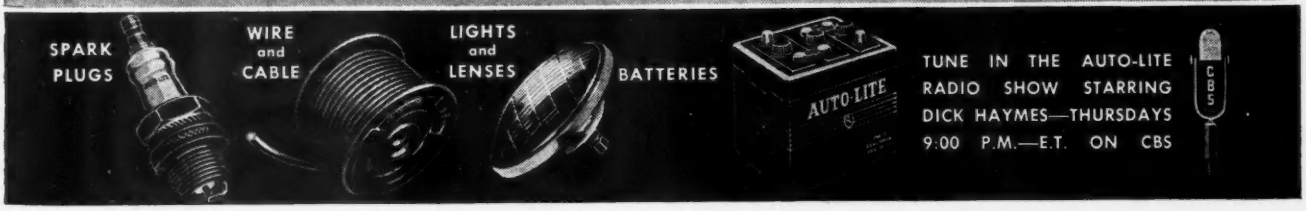
Quality Leaf Springs Since 1880

Switch to
AUTO-LITE
ELECTRICAL PRODUCTS
Built by the organization that makes complete electrical systems for many of America's finest cars, trucks and tractors . . .
MONEY CANNOT BUY
BETTER ELECTRICAL PRODUCTS
AUTO-LITE MEANS PRECISION MANUFACTURING

Leading automotive engineers pay tribute to the outstanding dependability of Auto-Lite products by specifying more than 400 Auto-Lite parts as standard equipment for finest cars, trucks and tractors. Such acceptance proves money cannot buy better products. Built in 24 great Auto-Lite plants these units include spark plugs, instruments, wire and cable, headlights, bumpers, plastic ornaments and panels, and complete electrical systems. A new booklet gives a more complete list of the many products Auto-Lite builds, alphabetically arranged for quick reference. Your copy will be mailed on request.

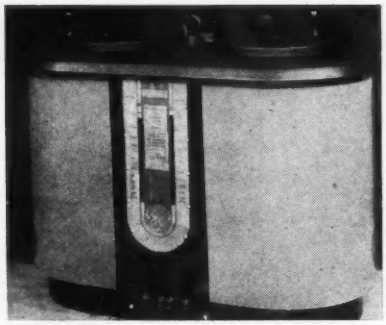
THE ELECTRIC AUTO-LITE COMPANY

Sarnia, Ontario **Toledo 1, Ohio**



Schenectady, N. Y. Each of the two circuits in the welder can be used simultaneously and independently with electrodes up to 3/16-in. in diameter, or combined into one circuit for heavy welding with ⅜-in. electrodes. The units have a current range of from 90 to 270 amp, when used singly, and from 180 to 540 amp when operated in parallel.

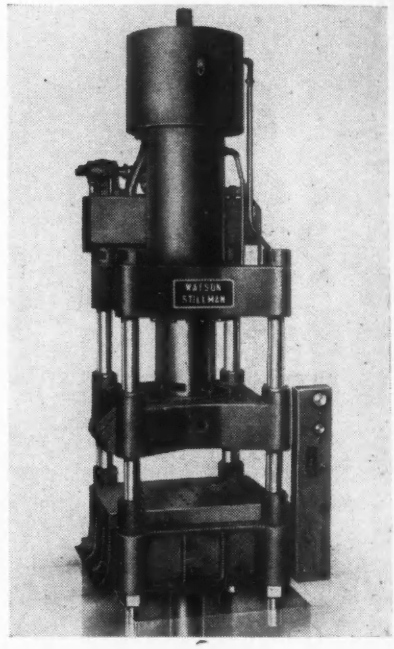
Both welders are equipped with controls which reduce the open circuit voltage to approximately 30 volts when the machine is not welding, but which make full power available the instant the arc is struck. Both halves are supplied through a single set of primary terminals, so that only one power-line circuit to the unit is required.



G-E twin-unit, outdoor a-c arc welder

Protection against rain, snow, and sleet is provided by dripproof construction of all openings in the top of the enclosure and by a sealed window over the current indicators. Ventilating openings at top and bottom are of such proportions that they shed water and keep the ventilating air velocity low.

WATSON-STILLMAN CO., Roselle, N. J., has introduced a 500-ton forming press with a 3 ft, 4 in. square die cushion. Working pressure of the press is 2000 psi controlled by a single knob. Manual control of the press is by a single lever and a push-button is provided for single-cycle operation.



Watson-Stillman 500-ton forming press

The press advances and returns at a speed of 300 in. per min. Speeds in compression are 30 in. per min for pressures up to 250 tons and 8 in. per min above that point.

This new machine occupies 42 sq ft of floor space, requires a pit at least 6 ft deep, and is 18 ft, 8 in. high.

A BENCH-TYPE grinding machine, especially designed for sharpening carbide tools with a steel-bonded diamond wheel, is manufactured and distributed by the Wickman Corp., 15533 Woodrow Wilson Ave., Detroit 3, Mich.

Known as the Wickman-Neven bench grinding and lapping machine, it is powered by a one-hp spindle motor of special design to withstand frequent reversal. A coolant pump is furnished as standard equipment, with a reservoir cast in the base of the machine.

For maximum convenience in sharpening both right- and left-hand tools,

(*Turn to page 64, please*)

WE HAVE ALL THE ANSWERS!

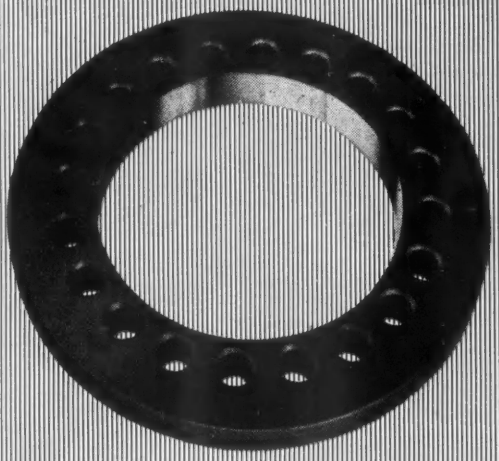
. . . For over fifty years, G. S. Blakeslee & Co. have been engineers of cleaning equipment. A great many problems have been solved and many bottle-necks in the production line have been eliminated with Blakeslee Metal Parts Washers and Solvent Degreasers.

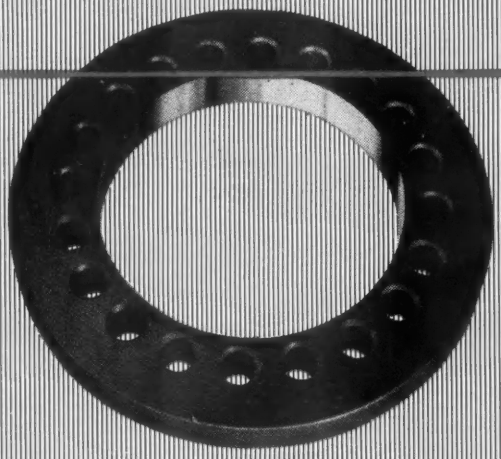
Numerous cleaning problems are encountered daily which are being solved by G. S. Blakeslee & Co. Let us give you the benefits of our broad experience in solving *your* cleaning problems.

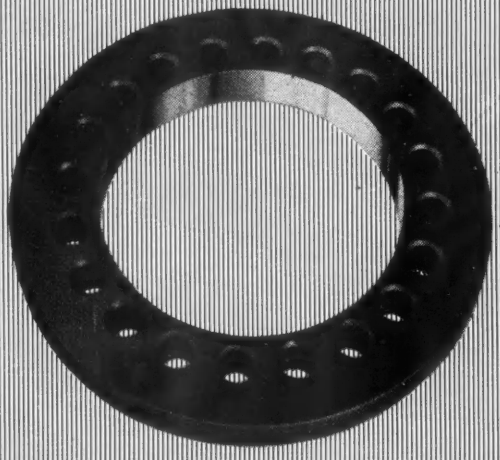
Write for free informative booklet; your request on your company letterhead will be taken care of promptly.

BLAKESLEE
Solvent Vapor DEGREASERS
Metal Parts WASHERS
STANDARD AND SPECIALS Engineered for you

G. S. BLAKESLEE & CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.







Round
Parallel
Straight
Accuracy
Fine Finish
High Production

=Bryant Method

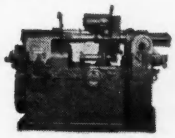
The Bryant Method offers an answer to any internal grinding problem you may have. With a complete line of grinders, plus an enviable background in engineering, Bryant has a combination that can produce parts with true straightness, parallelism and roundness—with a surface finish to millionths of an inch. And, at a production rate that is worth boasting about.

A good example of a Bryant solution for a tough internal grinding problem is shown at the left. The parts are *hardened steel* rings. They meet all required tolerances for roundness, straightness, parallelism and surface finish. The Bryant method allows rough and finish grinding with the same wheel, thereby eliminating further operations formerly necessary to obtain true accuracy and fine finish.

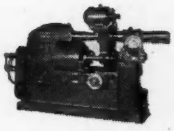
We know your problem is different . . .
but as long as it involves internal grinding and has as its objective high production of parts to very close tolerances, you should consult a man who makes a specialty of solving such problems . . .

Send for the Man from Bryant!

Series 112



Series 16

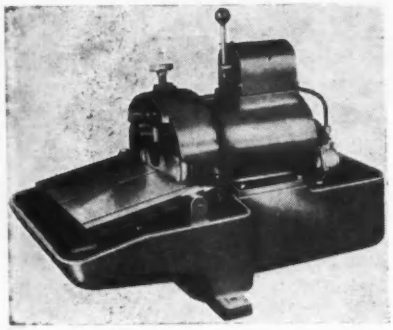


Series 24

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

BRYANT

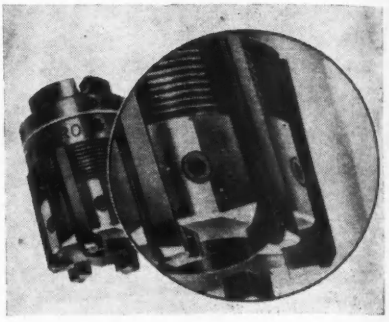


Wickman-Neven bench grinding and lapping machine

the direct-driven grinding wheel is reversed by a switch on the top of the motor. The wheel guard can be swiveled to right or left as required and clamped in position by a thumbscrew, and the eight-in. by 12-in. table is quickly set at any angle from 5 deg. above horizontal to 15 deg. below.

A LINE of heavy-duty, solid-shank and shell-type expanding reamers, featuring full-length carbide cutting edges, has been brought out by Metro Tool and Gage Co., 4240 W. Peterson Ave., Chicago 30, Ill. These reamers are also available in blades with high speed steel.

According to the manufacturer, the reamers are designed with a low expansion angle to lessen the OD grinding when resharpening and have a 1/16 in. blade overhang to increase rigidity without loss of chip clearance.



Heavy-duty reamer made by Metro Tool and Gage Co.

These reamers are available in cutting diameters of from one in. to six in. Shell arbors are furnished with straight or Morse taper shanks.

A NEW type of pattern plate, known as the Master cast and ground flat aluminum Tuff-Plate, has been added to the line of the Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, Ohio. A major feature is the use of tough knurled steel inserts which are cast integrally into each plate. Because of their hardness, these inserts reduce the wear by flasks to a minimum, and

Master cast and ground flat aluminum Tuff-Plate

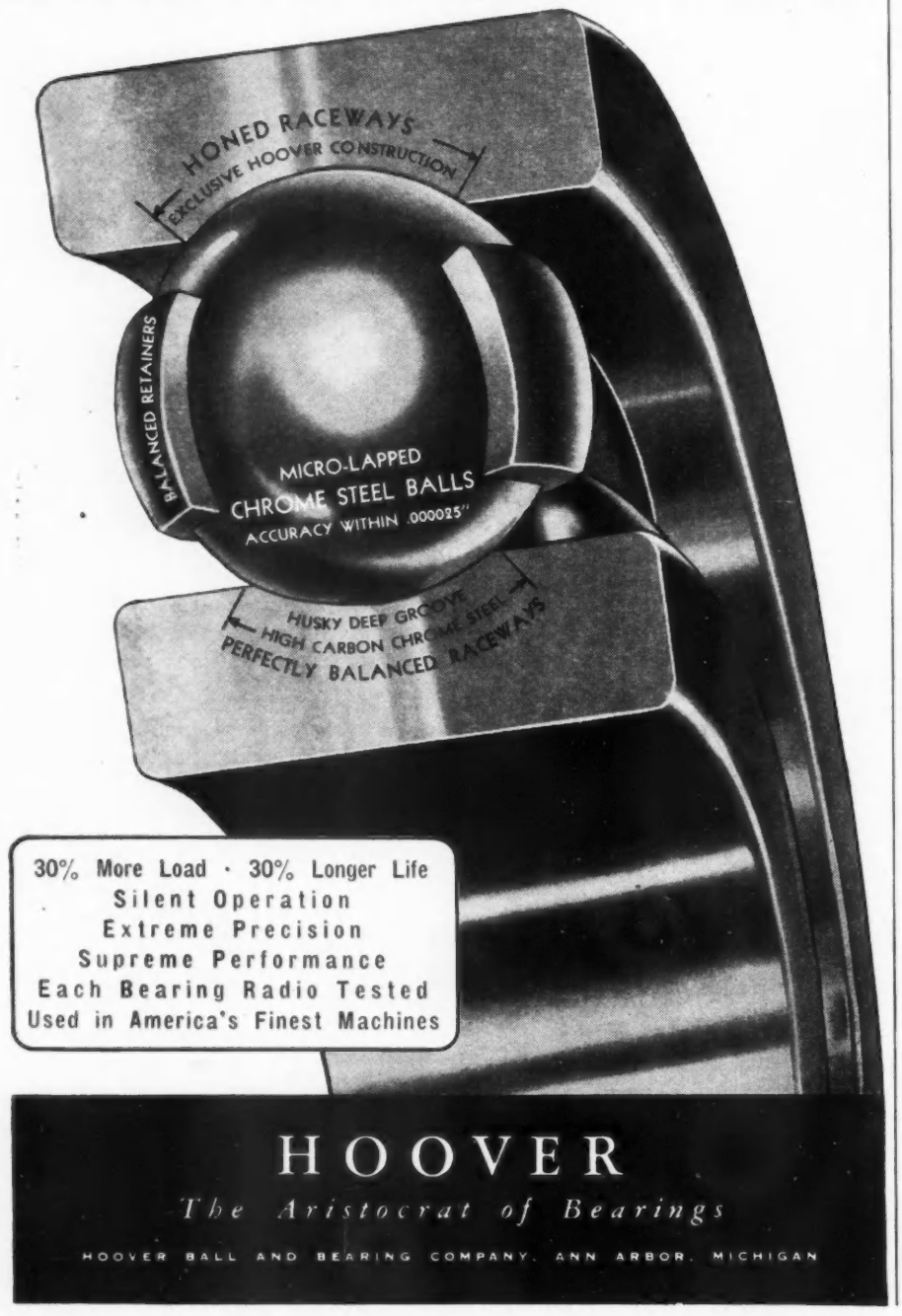
are claimed to greatly increase plate life.

The steel inserts are so placed around the outside perimeter of the plate as to effectively distribute and equalize wear at flask contact points. The surface of the plate is especially machined to prevent sand slippage. The entire plate is ground to ±0.003 in.

A one-in. allowance all around is made for flask strip. Three-in. standard ears at each end will accommodate all types of flask-pin guides. The edges are rounded for easy handling.

So much more...for so little more

AMERICA'S SUPER FINE BALL BEARING



30% More Load · 30% Longer Life
Silent Operation
Extreme Precision
Supreme Performance
Each Bearing Radio Tested
Used in America's Finest Machines

HOOVER

The Aristocrat of Bearings

HOOVER BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN

Parts Situation

(*Continued from page* 39)

problems which have kept new car output low apply to the parts industry. The wave of strikes in parts plants ober the 18½-cent wage increase has definitely kept the industry from reaching much higher levels. The same can be said of the shortage of basic materials, ssuch as steel and copper. The bad material and labor situation in the foundry industry has had a very adverse effect on castings.

The price structure under the Office of Price Administration has had some effect, since original equipment parts in most cases have no ceilings while those built for replacement have been held to 1941 price levels except in cases where 200 manufacturers of replacement parts were given individual price adjustments during this year. As a result vendors liked to concentrate on parts for new cars, although they have done a good job in keeping replacement parts flowing in considerable volume. To step up the production of automotive replacement parts still higher, on August 24 OPA granted 15 per cent increases in the manufacturers' ceiling prices for all automotive parts except the following raises: dump bodies and hoists, 24.5 per cent; general purpose anti-friction bearings, 12 per cent; fan belts, 17.3 per cent; radiator hose 26.8 per cent; engine and engine parts, 15.5 per cent. OPA states that costs of parts manufacturers have increased over 15 per cent, wages being nearly 35 per cent higher than on Jan. 1, 1941.

Automobile manufacturers report that most of their trouble in keeping adequate supplies of replacements going to dealers, jobbers, and other distribution points arise with outside vendors. Where dies have been destroyed and the number of parts required is relatively small, hand building has been done in some cases. In others, where a larger run is required, temporary tooling is the answer. In either case, since prices are held at '41 levels the cost is high, and must be charged off to customer good will. Packard, for example, reported it lost $350,000 on its parts business in 1945, although the volume was up 20 per cent. However, this may have been due to a large percentage of custom work required and since that time tooling undoubtedly has been completed.

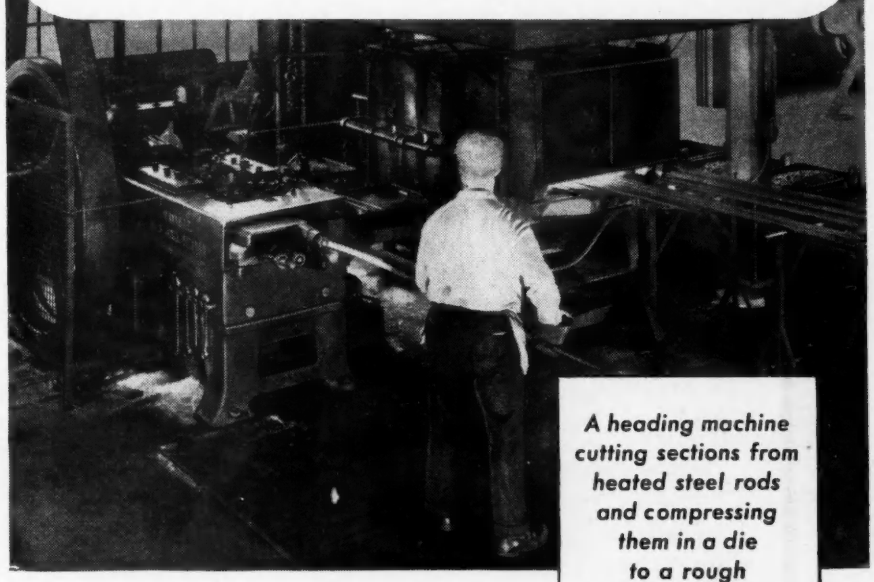
Car manufacturers have done a good job in producing and ferreting out scarce parts. One company spent a month looking for a crankshaft for a 1937 model. It finally located one in Mississippi and flew it to Chicago. In another case, a main bearing was flown from Atlanta, Ga., to Wisconsin for a car out of service for five months. Most companies have set up special "bird dog" departments to hunt for scarce parts. One manufacturer reports that junk yards are being scavenged for parts which can be rebuilt. Automobile Manufacturers Association reports that backlog orders for parts now are 400 per cent greater than a year ago. One company is geting more than four times as many letters as it did in 1944 from owners telling of their inability to get repair parts. Another says such letters from owners are running 20 times the normal rate. It is reported that most automobile companies now are not back ordering repair parts. They simply ship the parts they have in stock and request the customer to reorder missing parts later. Some make exceptions when the parts are badly needed to put a vehicle into service, but in general the paper work of back ordering under present conditions of huge demand and short supply is too burdensome and time consuming for the help available.

While all parts are in short supply, certain categories appear to be in much worse shape than others. A survey among jobbers, dealers, and independent repair shops shows one may

(*Turn to page* 69, *please*)

This is How

STROM BALLS are Born



A heading machine cutting sections from heated steel rods and compressing them in a die to a rough spherical shape

The steel is carefully chosen and inspected, even before it gets to the heading machine. After being "born" here, balls are carefully "brought up," through a long series of grinding and lapping operations, to the unbelievably high standards of finish, sphericity and precision which have made Strom Metal Balls the standard of Industry. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

AIR DRILLS
by ARO
DELIVER MORE POWER...
WITH LESS WEIGHT
A Complete Range of Air Drills for all types of continuous production work...up to ½" capacity.
A Model 101, plastic housing, ¼" drill. 2500 R.P.M. Weight 1 lb. 9 oz.
B Model 109, aluminum housing, ¼" drill. 2500 R.P.M. Weight 2 lbs.
C Model 7027, pistol grip aircraft drill. 7000—17,000 R.P.M. Speed adjustable.
D Model 7028, button throttle aircraft drill. 7000—17,000 R.P.M. Speed adjustable.
E Model 22PDX, pistol grip throttle, ¼" and 5/16" drill. Weight 2 lbs. 9 oz.
F Model 22PDZ, pistol grip throttle, ⅜" drill. 2500 R.P.M. Weight 3 lbs.
G Model 7012, ¼" drill with No. 2 Morse Taper Head.
H Model 22BRY, right angle ¼" drill.
I Model 135, ⅜" drill. Weight 5¾ lbs.
J Model 7016, up to ½" capacity drill. Has variable position auxiliary handle. Weight 6¼ lbs.
Do your drilling faster and better with ARO Pneumatic Tools...also specify ARO for screw-driving, nut-setting, grinding, polishing, sanding, filing and other production jobs. Precision-built ...dependable. Write for literature. The Aro Equipment Corporation, Bryan, Ohio.
NEED TOOLS NOW?
SEE YOUR ARO JOBBER!
ARO

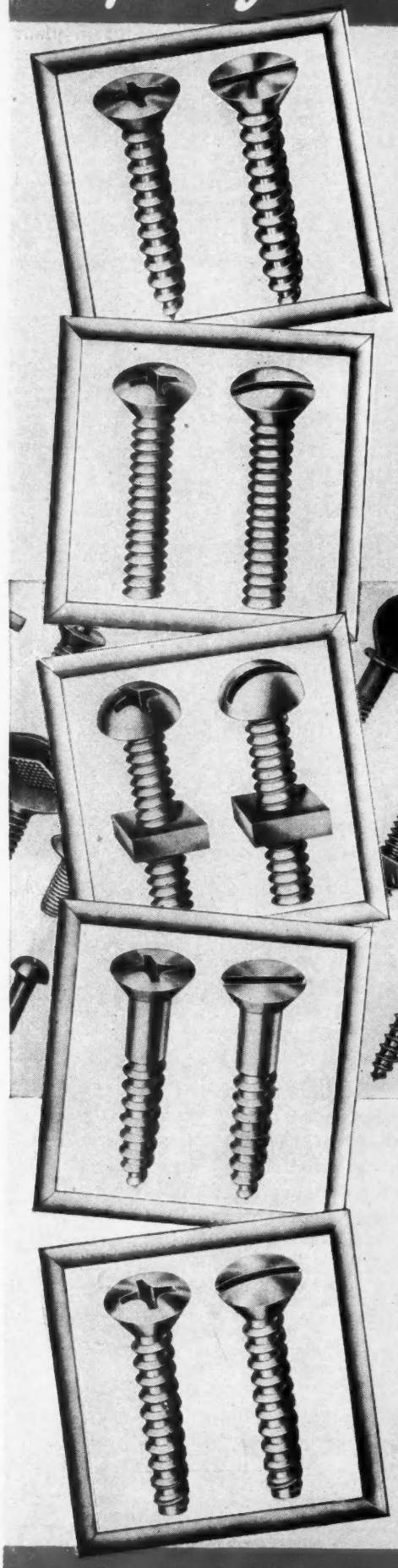
be having the most difficulty with bearings, whereas another finds crankshafts harder to find. A further inquiry reveals that they buy from different suppliers, which accounts for the difference. However, parts commonly conceded to be in tightest supply are bearings, wormshafts, crankshafts, transmission gears, mufflers, braker drums, cylinder head gaskets, radiator cores, and front and assembly parts. While these are said to be hardest to get, practically any part containing steel is certain to be troublesome. Batteries and brake fluids also are scarce, and jobbers report that anti-freeze will be in limited supply next winter. One wholesaler said his order has been cut 50 per cent from the amount originally consigned to him.

One automobile manufacturer says that at present 600 of the most scarce replacement parts are on allocation, with orders filled in ratio to past history of the particular account. This company also reports that the replacement engine business has jumped phenominally. Last year it was 20 times greater than in 1941 and this year bids fair to be even larger. The spokesman said that in a recent sampling of repair shops, it was discovered that not more than six cars in a hundred were held in the shop because of lack of parts. In general, while the situation is serious, there is some reason to believe that replacement parts are improving in supply just a little. It still will be a long time before all parts are in balance with demand, however, and some of the more pessimistic jobbers look for another year to 18 months of shortages. They say that strikes still are a major factor, that new car production does not appear to be improving very fast, and that in most cases, cars which are turned in on new ones must be reconditioned and therefore dip into the available parts supply. Another reason for a continuation of parts shortages given by several spokesmen is that the Crawford amendment in the new OPA law has shoved the prices of new cars so high by restoration of dealer discounts that many owners will now find it more economical to put more money into an old car and fix it up rather than to buy a new one at inflated prices.

Official figures on automotive replacement parts production show that output now is far above that of any prewar year. The following figures are for civilian parts only, so the factor of war production does not affect the totals. In 1941, the largest peacetime year, production of replacement parts, based on manufacturers' prices, amounted to $596.2 million. In 1942 and 1943 it dropped to $522.2 and $501.2 million, respectively. At that point, Government authorities became alarmed at the threat to civilian transportation and relaxed restrictions somewhat, so that in 1944, output rose to $747.1 million, a new high. In 1945

(*Turn to next page, please*)

Complete Your Production Picture



WITH HOLTITE Fastenings

In your present and future production plans, careful consideration should be given in determining the type of fastenings best suited for each particular application.

Eliminate all doubts by submitting your fastening problems to our Engineering and Laboratory Staffs. They will complete your production picture by recommending the most efficient, economical method of fastening the vital parts of your products. Specify HOLTITE engineered fastenings — made with the precision of small tools

HOLTITE PHILLIPS RECESSED HEAD SCREWS

Cut fastening time in half by changing to HOLTITE-Phillips Recessed Head Screws and bolts. Replace hand driving with safe spiral and power driving even on finished parts. The tapered bit cannot slip from recessed head to spoil work or injure operator. Adopt this modern screw driving method as standard practice to reduce fastening time an average of 50%!

CONTINENTAL SCREW CO

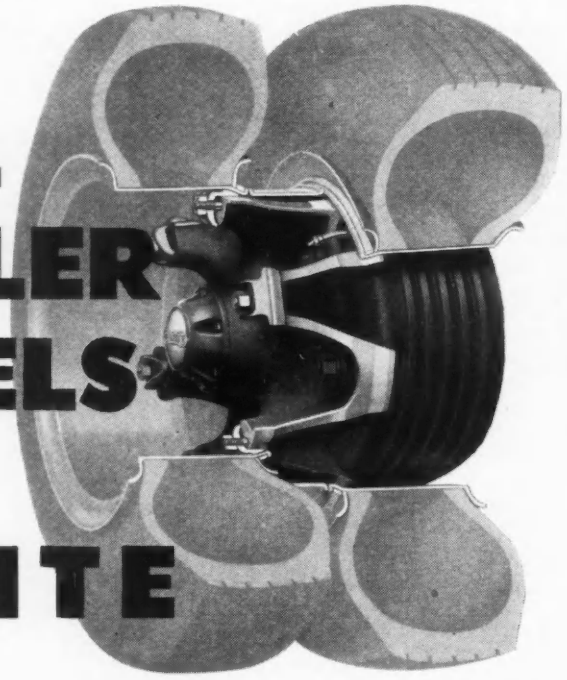
New Bedford, Massachusetts, U.S.A.

the upward trend continued, with production reaching $972.7 million. On the basis of figures for the first four months of this year, the last available, replacement parts sales this year will be more than double the prewar high reached in 1941. Although the figures cited are in terms of dollar volume, the comparisons are valid, since under OPA ceilings prices have been held generally to prewar levels during the first eight months of this year.

There is little doubt that the parts industry has the capacity to produce, in record volume. During the war, most parts companies expanded to take care of military needs. In addition, many of them produced aircraft parts, which are no longer needed and that additional capacity can be turned into automotive parts production. The principal troubles do not lie in plant capacity or equipment, but rather in labor troubles, shortages of materials, and lack of manpower, which now is beginning to be felt. Certain types of alloy steel are very difficult to get. One company reports that it no longer can import ball bearings as it did before the war.

From the foregoing statistics it does not appear that production has suffered greatly from OPA pricing structures, and it is a credit to the parts industry that it has continued to produce in the face of restrictive ceilings. Yet, there undoubtedly have been some cases where items on which losses were suffered have been curtailed or dropped.

CAST STEEL TRAILER WHEELS BY GUNITE



IMPROVED "GIRDER" DESIGN PROVIDES GREATER STRENGTH AND RIGIDITY

A distinctive feature of GUNITE Cast Steel Trailer Wheels is the *continuous web* which, in section, resembles the diagonal braces in a bridge truss. When the rims are seated on the off-set bearing surfaces, the assembly achieves a true truss construction. This provides maximum strength and rigidity with minimum weight. The complete assembly includes a specially-engineered Gunite rib-type long-life Brake Drum. The wheel is furnished with bearing cups, rim spacer, cast hub cap, and all rim-attaching parts. Gunite Trailer Wheels are available for 15000, 16000, 17000, and 18000-pound axles. *Write for detailed specifications and deliveries.*

MADE BY GUNITE FOUNDRIES ROCKFORD, ILLINOIS

GUNITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES

Three British Jet Engines

(*Continued from page* 33)

are in turn integral with the first fan drive disk. The 56 blades of the second fan stage are anchored in a ring that is integral with the tips of the second and fourth row of fan drive blades thus making a bridge across the third row. Both the second and third row serve as directional turning vanes, for their respective following stages, as well as impulse blading. This idea would seem to be a good one for some designer to apply to an entire gas turbine, i.e., have counter rotating axial flow compressor blading and turbines thus eliminating all stator blades in both components. A considerable saving in weight could occur but might be offset by additional weight due to necessary complication of drive members. Maximum operating speeds of the fans are 2850 and 2300 rpm for the first and second wheels respectively as compared to 7600 rpm maximum rating speed for the main turbine wheel.

The compressor of the F.3 is a nine stage axial flow type with 68 blades in each row of the rotor and 70 blades in each stator row giving an overall pressure ratio of 4 to 1 at 7600 rpm. All rotor blades are of the same airfoil contour and vary only in length from stage to stage. This is also true of the stator parts, thus giving a measure of standardization so dear to the hearts of production engineers.

The Metro-Vick combustion chamber is different in almost every respect from those found in other British units in that it is annular in configuration, has a perforated flat ring plate for creating mixing turbulence of the primary air, and has 20 very simple fuel nozzles. Secondary air flows through annular cooling passages around the ID and OD of the combustion chamber and is admitted to the burning space through four rows of 20 tuyeres each. Fuel is delivered to the burners at 650 psi by a single lever throttle control, and pump system that incorporates an altitude compensation device and an overspeed governor. At the end of the combustion chamber, 56 fixed blades form the first stage nozzles directing the hot gas into the first of the two main rotor stages of 80 blades each. These two rows are separated by 84 fixed blades.

Structural arrangement of this unit may be comprehended by studying the drawing, Fig. 14, by Max Millar. Air for cooling is tapped off the compressor in three places. Holes are drilled through the rotor drum just after the fourth stage allowing air to flow

(*Turn to page* 74, *please*)

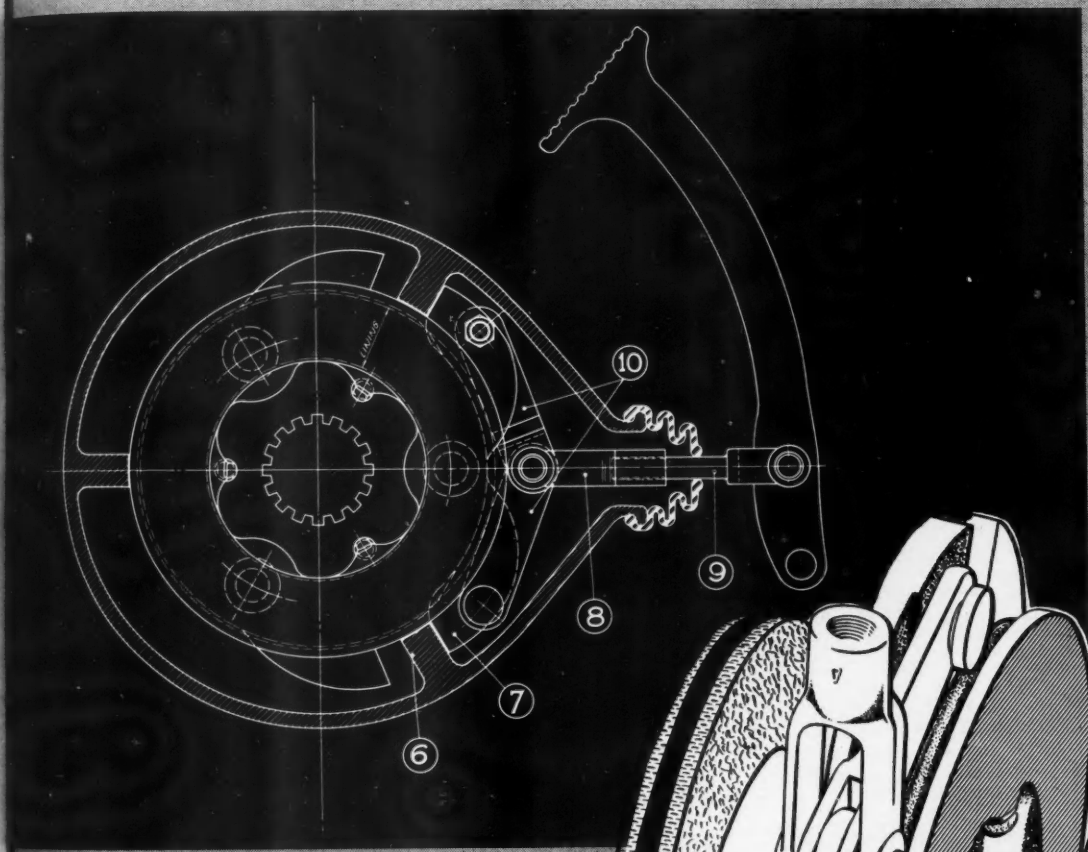
1 A Simpler, Smaller, Lighter-Weight Brake especially designed for use on tractors.

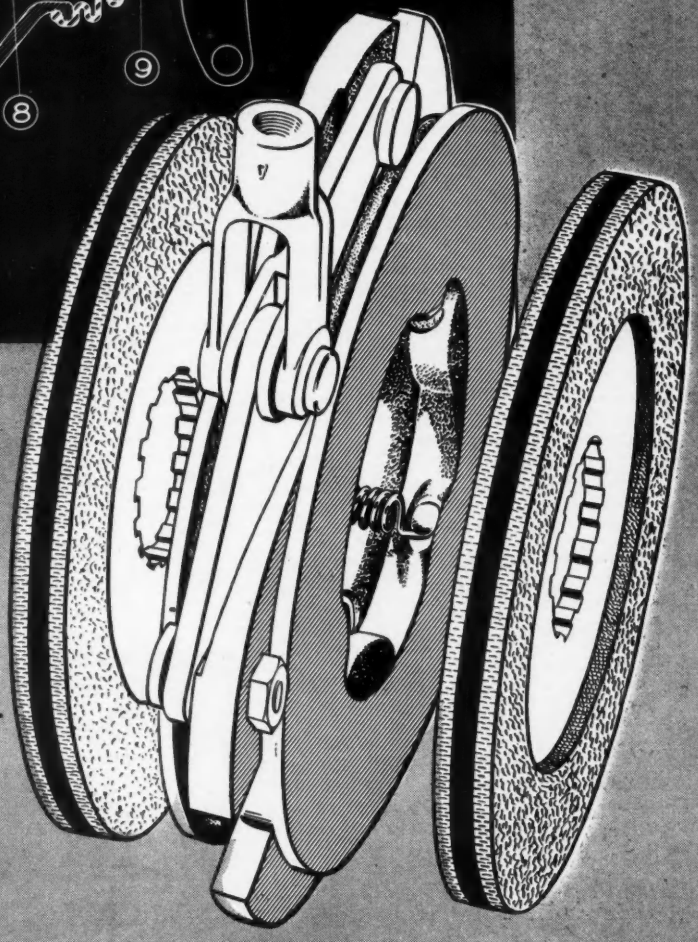
2 Fully Tested and Approved.

3 Greater Efficiency . . . More Power.

4 Very Quick and Simple Adjustment.

5 Equally Effective in Braking Forward and Backward Motion.





6 Light Pedal Pressure.

7 Effective Steering.

8 Four Effective Braking Surfaces.

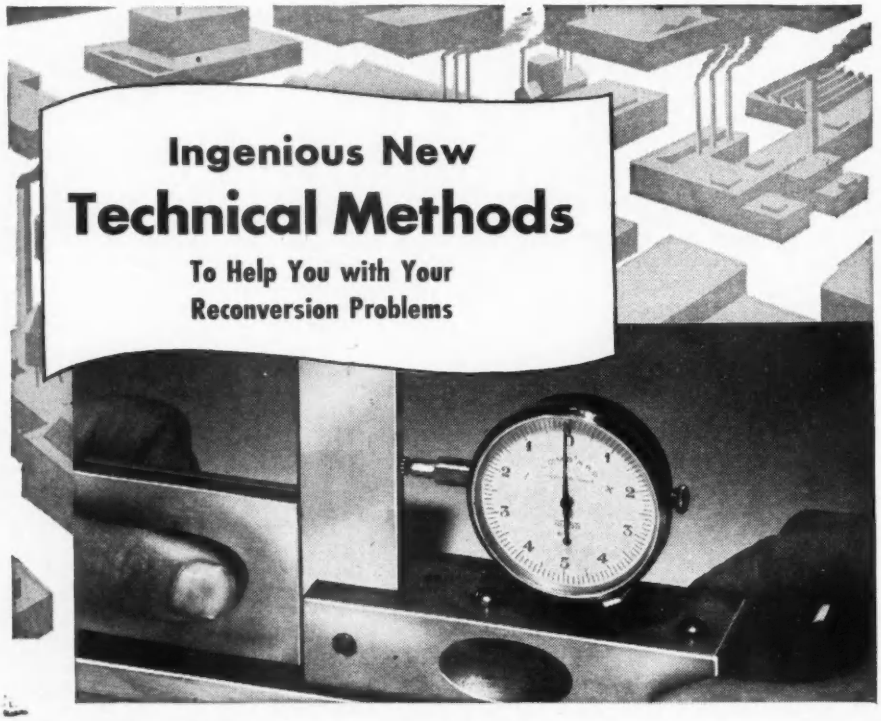
9 Longer Brake Lining Life.

10 Easier to Assemble.

11 Fewer Parts, Which are All Interchangeable.

through the inside of the drive cone to the rear bearing where it atomizes oil for spray lubrication of the balls and cools as well. Although not readily seen in the drawing, the flow path from the bearing is through an annulus formed by coaxial heat shields, and on out through hollow members across the compressor discharge to an external duct which surrounds the compressor outlet. Clearance is such at the end of the compressor rotor that some air bleeds off and flows between the drive cone exterior and the adjacent shell, through passages around the outside of the bearing housing, and out along the front face of the main turbine disk to the hot gas stream as it enters the first row of rotor blades. The third cooling air stream is tapped off at the sixth compressor stage, and is led by means of external lines to the tubular frame which supports the jet thrust cone and the fan turbine. Part of this flow is used to aspirate oil for spray lubrication of the fan bearings and then passes through the tail cone to be ejected at the end. The other portion of the flow makes its way around the bearing housing and cools the front surface of the first fan disk and the rear face of the main turbine disk to finally join the main stream of hot gas as it enters the first row of fan drive blades.

With the ducted-fan thrust augmenter, the outside diameter of the unit is approximately 48 in. Weight is quoted at 2200 lb with static thrust rating of 4000 lb, giving a weight per lb thrust ratio of 0.55. It is claimed that the slower moving cool envelope of augmenter discharge air has a noise suppression effect that makes this unit the quietest aircraft power plant yet produced. The builders feel that the F.3 has great possibilities for civil transport airplanes.

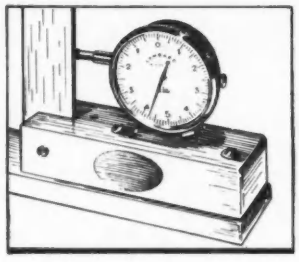


New Micro Square Instantly Checks Right Angles to One 10,000th Inch!

Ideal for precision testing, the Acro Micro-Sine Square quickly and accurately checks right angle work to 1/10,000th inch within a given distance. Its standard indicator dial instantly registers error, location of error, and amount of correction required. Designed for tool and die shops, machine shops and testing laboratories, it also provides a standard for checking master squares, tri-squares and tools.

The Acro Micro-Sine Square is very simple to operate, saves hours of time. Made of hardened tool steel, in ground and lapped precision construction. Available in two types: (1) Standard precision gauge in tenths, (2) Lever indicator in thousandths. Both complete with master checking blocks and carrying cases.

On precision jobs, requiring a static position and mental alertness, workers undergo nervous tension which often results in fatigue. Tests have shown that the act of chewing helps relieve tension—helps workers stay alert, thus increasing their efficiency to do more accurate work. For this reason, many plant owners urge workers to chew Wrigley's Spearmint Gum on this type of job.



Standard Indicator Dial

You can get complete information from Acro Tool and Die Works 4554 Broadway, Chicago 40, Illinois

AA-88

Use of Ether as Ignition Agent

(*Continued from page* 42)

ber. By causing the spray to impinge against the exhaust valve a considerable improvement was noticed throughout. This improvement, both in fuel consumption and in power output, is illustrated on Fig. 6, where three conditions are shown: first, a straight spraying of R-300 into the combustion chamber, the air being cooled to 1 C; this condition is the worst of the three! Then the same direction of spray but with air slightly warmer; even this small difference shows an improvement. Finally, with air at —1 C but with the spray of R-300 directed against the exhaust valve. A decided improvement is noticeable, power output higher, fuel consumption generally lower. Average consumption of R-300 was 2.5 kg per hr, which is rather high. The output, especially for rich mixture, was equally as good as for spark ignition, and the fuel consumption, especially at lean mixtures was decidedly better.

Tests were then conducted with a BMW 323 9-cylinder engine in a Junker JU-52. Compression ratio was 8 to 1; take-off power 1000 to 1050 hp at 2500 rpm; climbing power 800 hp at 2250 rpm. The fuel consumption averaged 210 g per hp per hr. The R-fluid consumption was 1 to 1.2 kg per hr per cylinder, that is 15 to 23 cu mm per stroke. At no-load the use of R-fluid increased to 40 cu mm per stroke. The Ring Process was used in the middle engine of a group of three on the plane. Tests showed that the high rate of cooling would cause difficulties, and a different set-up had to be used.

The next series of tests was therefore run, also in a Junker JU-52 but with a BMW engine having a compression ratio of 9 to 1 instead of 8 to 1. Average fuel consumption was 185 g per hp per hr. R-fluid consumption was 18 to 23 cu mm per stroke per cylinder and again 40 cu mm at no-load. It can be said that the R-fluid consumption is from 5 to 10 g per hp per hr.

Unfortunately this plane could not go above altitudes of 5000 meters,

(*Turn to page* 76, *please*)

PITNEY-BOWES *tells independent investigator:*

"That's just the time-saving we can measure," explained Pitney-Bowes' production manager to the James O. Peck Co. investigator, who is studying assembly savings with Phillips Screws in well-known plants. "Since using Phillips Screws on our postage meters, we have found that the time savings we *can't* measure exactly are even larger.

"NO TIME WASTED STARTING THE SCREW . . . the Phillips Screw doesn't wobble and slip off the driver. The operator uses his left hand only to start the screw. He can drive it up tight without wasting time. With a slotted screw, he'd have to ease it home more slowly to avoid burring the head. And, we can't risk mail-tearing burrs on screws that secure the polished mail feed plate and mail stacking assembly.

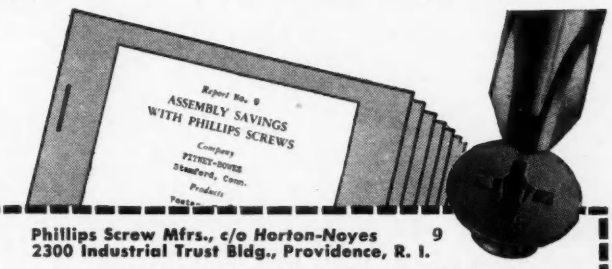
"TAKES LESS TIME TO BREAK IN NEW OPERATORS. Anyone can learn faster to drive Phillips Screws than slotted screws. The Phillips driver automatically aligns itself with the screw and holds its position as the hand shifts, while the conventional driver is apt to slip out of a slotted head screw.

"DRIVER SLIPS USED TO COST US ONE MAN-HOUR PER SLIP . . . before we changed to Phillips Screws. When a driver marred one of the satin-finished, nickel-plated pieces which guide the mail in these machines, the part had to be removed, pickled, refinished, and replated. That took about one man-hour . . . not to mention time lost through interruption of production line momentum."

GET PITNEY-BOWES REPORT AND OTHERS. Available to you now are nine independently made studies of assembly practice in famous plants, making metal, wood, and plastic products. A mine of ideas for cutting costs and ending trouble. **FREE,** of course. Use the coupon **TODAY.**

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts



26 SOURCES

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
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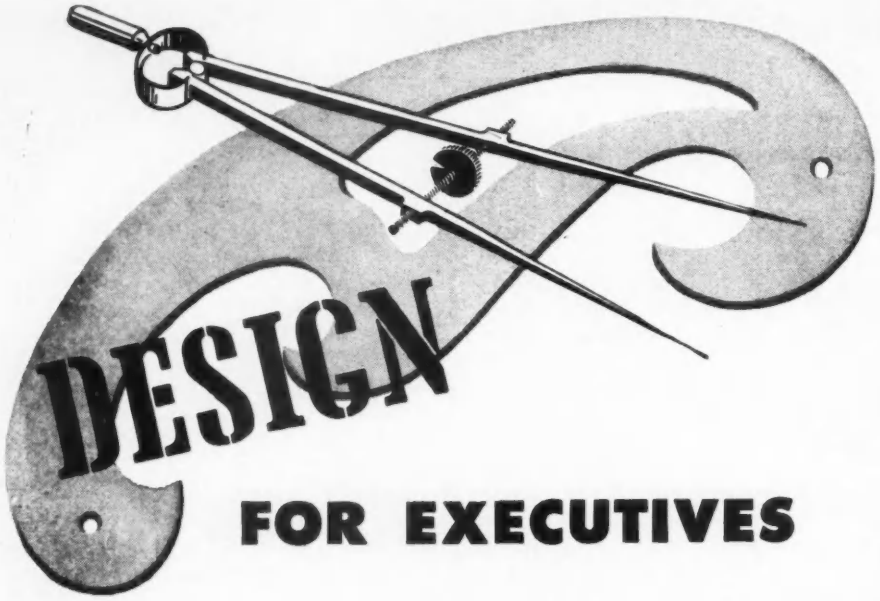

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The design for a successful executive has been "blueprinted." A straight-line production plan has been laid out for *quality* production. The new method fits into today's fast moving conditions, and accomplishes in months what once took years.

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where difficulties were really expected due to excessive cooling, and further tests were planned. But in the winter of 1943-44 perhaps due to some improvement in the spark ignition technique in Germany, perhaps due to greater interest in other types of plane propulsion, it was decided to interrupt this work on account of what was termed "more pressing interests."

Problems Related to the Ring Process

Two problems were given consideration in connection with this process. The first is the problem of starting the engine, especially at low temperatures. It soon became clear that a set of auxiliary spark plugs, used only for starting, were an indispensable accessory of the Ring Process, together with battery, distributor, and all the electrical equipment necessary.

The second problem was one of reducing the cost of installation of the Ring Process, definitely higher than the cost of spark-ignition, by eliminating some of the injection equipment. The Hirth Motor Co. adopted an injection system developed for small Diesel engines, and similar to the pre-gasification injection of the Cummins Engine Co. in the U. S. A.

It can be said that the main advantage of the Ring Process compared to the spark ignition method lies in the elimination of spark plug difficulties, serious in Europe at the time of the development of the process. A saving of fuel of approximately 5 per cent can also be expected as a result of more knock-free performance and of more economical use of fuel in the lean mixture operating periods. The fact that less cooling is necessary may be considered either an advantage or a disadvantage inasmuch as a careful control of the cooling process must be provided to avoid excessive cooling and resultant failures.

Involutometry and Trigonometry

Michigan Tool Co. of Detroit, Mich. has published a technical book, "Involutometry and Trigonometry," of 326 pages, containing numerical tables, formulas and miscellaneous data intended to simplify engineering calculations relating to the design and manufacture of products based on involute curves and surfaces, such as gears, gear tools and splines. The main table consists of seven-place natural trigonometric and involutometric functions. Appendix A includes conversion tables, formulas for involutometry, cycloid tracing tables, involute tracing tables and polygon tables. Gear Appendix B presents many entirely new tabulations of gear formulas, constants and standards of value to gear engineers. Appendix C treats the principles of plane and solid involutometry. Dr. Werner F. Vogel, Associate Professor of Engineering at Wayne University, Detroit, is the author. Price is $20.

New BULLARD MAN-AU-TROL SPACER

Saves time, money and labor in your Drilling Operation

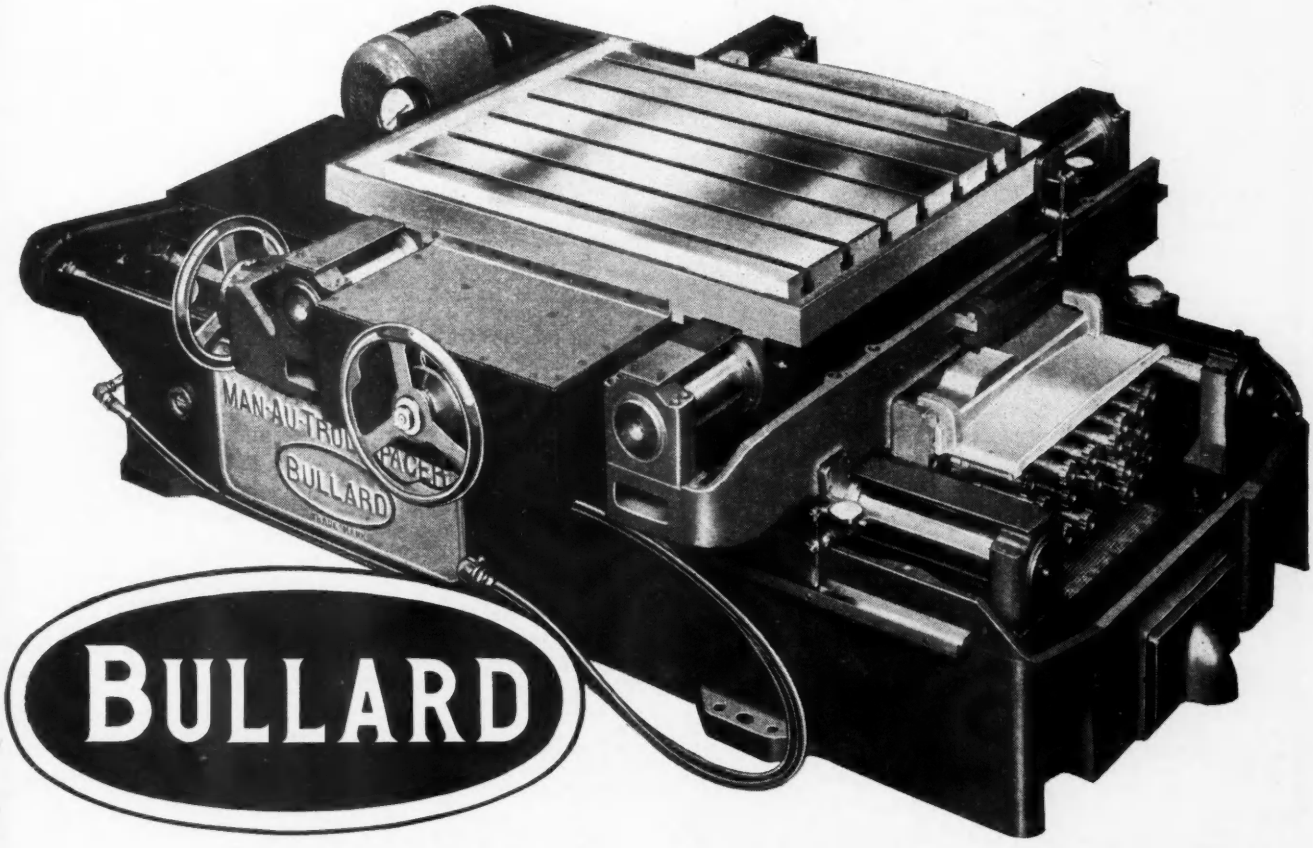
NOW...

BULLARD ELIMINATES JIGS for drilling, boring, reaming, tapping!

Designed for installation *by you* on your drills, the new Bullard MAN-AU-TROL Spacer, in most cases, eliminates hole-locating jigs... and the time, money and labor required to design, make, handle, repair and store them.

With unprecedented speed, ease and accuracy, you can set up the Spacer to do the work of jigs that may take weeks or months to make. Once its lateral and longitudinal position stop rods are set for a pattern of holes, the manually controlled, automatically operated Spacer will repeat that pattern indefinitely *to the highest standard of commercial spacing accuracy.* Extreme flexibility permits the use of the Spacer on a large variety of large and small work.

The results: faster, more accurate production . . . lower costs . . . less overhead . . . less human fatigue —all valuable factors in improving your competitive position. Write for MAN-AU-TROL Spacer Bulletin. The Bullard Company, Bridgeport 2, Connecticut.



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Made in 2 sizes — 30" x 20" (illustrated) for larger work on 4', 5' and 6' Radial Drills; and 4" x 4" for work usually done on smaller types of drills.

New OPA Headaches

(*Continued from page* 17)

There are several important points here. One is that application is to be made on an industry-wide basis through an advisory committee. Another is that averages are to be used to determine both the base dollar price of the product and the increase in costs since 1940. A third point is that "product" is defined as "any major item, or any article different in character from other products of the industry; but all styles, models, or other varieties of any such item or article shall be considered as one product." By this time the confusion is complete.

In the first place, the automobile manufacturers do not have an industry advisory committee on pricing. One reason is that most companies believe it might be a violation of the anti-trust laws to have industry-wide pricing. An interesting sidelight to this is the report that OPA right now is trying to get an opinion from the Department of Justice on just this question. Another reason is that such a committee system very likely would involve showing highly secret cost figures to competitors. Increases in car prices granted previously were on an individual basis, with each company submitting its costs to OPA and asking approval of a price. Now if industry committees are required, there is some doubt that the car makers would agree to one. Probably the nature of the figures which OPA will require will have a great deal to do with the decision. If they are the kind that could show weighted averages without revealing too much, there is a possibility that the industry might agree. At any rate, it would take some considerable time to poll the industry and to appoint a committee.

Another development under the law is that it calls specifically for averages *for the industry* in setting up profit returns, cost increases, and base sales prices for a product in 1940. It also provides that maximum prices which meet the profit formula for the industry are not invalid if they do not meet the costs of any particular member of the industry. However, the administrator still has power "to make reasonable adjustments and exceptions" in individual cases under the hardship provision of the act. The whole answer to whether or not the pricing procedure will be workable in the automobile industry will rest on just how OPA interprets the various sections of the new law. If it decides to follow the letter of the law, any practical application appears to be almost impossible. If it decides to interpret reasonably the confused terminology relating to average prices, average costs, and what constitutes a product, the industry has a chance to get some relief.

Paul Porter, OPA administrator, recently said that his agency "intends to follow both the letter and the spirit of the law." It is hard to see how it can do both. He also said that "the law states specifically that the industry advisory committees must provide cost and price figures to the OPA and that increases can be granted only after such data have been made available." From this, it is quite obvious that the automobile manufacturers will have to work on an industry basis if they want price relief, which certainly is much more undesirable than the former method of each company dealing individually with OPA. A possibility suggested by one company representative to get around the objection to sharing competitive cost information would be for an industry advisory committee to retain the services of some certified public accounting firm to gather the figures on a confidential basis and to present them as an industry average without revealing the identity of any particular company's data. Whether this would be acceptable to OPA, of course, is not yet known.

At any rate, it is clear that with the long involved process set up under the new law, it will take weeks and months

(*Turn to page* 82, *please*)

It's there . . . in clean, true lines that tell of patient seeking for perfection of strength and stamina: that "look" of champions. In a noble dog it pays off in cups, ribbons and "Best of Show." In the Aetna Bearing it pays off in silent, durable efficiency that outlasts the vehicle.
You know the trusted Aetna "T" Type Bearing . . . the recognized standard at the crucial clutch release position. It is famous for its permanent true alignment, assured by the "T" retainer; for the absence of eccentric thrust, chatter and excessive wear; for its pre-lubrication, sealed in permanently.
Aetna manufactures many types of ball and roller bearings. And a wise step, with any bearing problem, is to talk it over with Aetna Engineers. Aetna Ball and Roller Bearing Company, 4600 Schubert Avenue, Chicago 39, Illinois.
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Just a few flexible wires from truck battery to brakes.
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The Warner Electric Brake is a simple mechanical brake, operated by an electro-magnet and armature disc. Each wheel is a complete brake unit. The braking power is generated within the brake itself. A wire to the battery and a controller complete the system — famous for its simplicity.

WARNER
ELECTRIC BRAKES

to get an advisory committee organized, the required comprehensive data assembled and a final decision from OPA. The administrator has 60 days to revise prices after the figures are in. If no action then is taken, the industry may petition the Emergency Court of Appeals which has authority to order the administrator to make an adjustment or deny the application within a stipulated time, not to exceed 30 days. So, as the law is written, OPA if it so chooses can hold off prices on new cars at the manufacturing level for from two to three months after date of application, which means the new car prices would still be from three to four months off, considering the time required for organizing the industry's application. It still is too early to tell whether the car manufacturers are willing to go through with all the red tape required under the law. As one spokesman said, "By the time we could get price increases approved, we might be at or past the break even point so that we would not need relief."

Industry Needs the Census

(*Continued from page* 15)

people in so short a time. Since the last Census some 10,000,000 persons have been added to the population total. The truth is that American business does not know enough about developments that took place during and since the war to conduct its affairs efficaciously.

The Bureau of the Census of the Department of Commerce, after consultation with all interested groups, recommended censuses of manufactures, of wholesaling, retailing and the services, as well as a sample census of population and a study of consumer income. This was approved by the Bureau of the Budget and passed by the House of Representatives. The Senate denied the appropriations for the stated reason that no legal authority existed for these censuses. The real reason was political. It was feared the appointment of many census employes would help the administration. This will be even more true next year when a presidential election will be pending. If that reasoning were to prevail there would be no more special censuses because large numbers of temporary employes are required to gather the information. There always is an election just around the corner.

All good citizens at this time are doing their utmost to stabilize the economy and to bring about conditions that will prevent large-scale unemployment. One important step toward those ends is to secure fundamental facts. The Bureau of the Census is being maintained by the taxpayers for that purpose.

GOVERNMENT'S LIMITED INTEREST IN *71 PATENTS* FOR SALE

The Government's limited interest in 71 patents, listed below, is offered for sale in one unit to the highest qualified bidder subject to approval by the Department of Justice.

These patents (formerly owned by the Automotive Engineering Corporation) relate to motor trucks and like vehicles embodying *multi-drive axle units.*

Sealed Bid Sale—Bids close October 15, 1946, at War Assets Administration, Railroad Retirement Building, Washington 25, D. C.

The following is a list of the patents:

PATENT NO.	PATENT NO.	PATENT NO.	PATENT NO.
Re. 17,889	1,744,320	1,847,348	1,928,860
1,522,783	1,744,401	1,851,198	1,930,207
1,592,970	1,745,431	1,857,248	1,930,208
1,644,023	1,745,432	1,857,249	1,933,667
1,653,114	1,745,433	1,860,470	1,933,674
1,660,188	1,747,580	1,860,471	1,933,675
1,660,189	1,747,902	1,866,637	1,935,746
1,670,119	1,750,899	1,867,678	1,936,834
1,703,536	1,761,044	1,871,432	1,940,914
1,705,137	1,763,767	1,899,240	1,947,337
1,712,057	1,773,782	1,907,179	1,947,358
1,720,796	1,776,479	1,912,308	1,949,830
1,728,869	1,815,416	1,912,498	1,975,202
1,736,836	1,776,480	1,913,799	1,981,449
1,738,212	1,816,981	1,924,646	1,981,593
1,739,355	1,818,902	1,924,984	1,992,365
1,739,450	1,825,194	1,926,273	2,006,800
1,743,334	1,845,674	1,926,274	

Copies of these patents can be obtained from the Commissioner of Patents or examined in many of the larger Public Libraries. A copy of the assignment to the Government can be obtained from the Commissioner of Patents (Liber C192, Page 179).

For additional information and copies of the Report to Congress dealing with these patents write to:

WAR ASSETS ADMINISTRATION

Railroad Retirement Bldg., Washington 25, D. C.

682

Belgian Production

(*Continued from page* 38)

ducers, and many of them were carrying on substantial re-exporting programs from their Belgian plants. Labor costs have officially gone up 2.4 times for all of Belgium since 1939, and the automotive industry estimates the figure in its industry at three times. In addition this industry in common with all others will bear increased costs amounting to 15 per cent from the broad social program which has been instituted.

The industry expects the planned customs union with thte Netherlands to expand the demand for passenger cars assembled in Belgium within the next two or three years.

Evans Appointed Chairman Of Michigan Aviation Week

Robert B. Evans, vice-president of Evans Products Co., Detroit, has accepted appointment as Chairman of Michigan Aviation Week, to be held April 18-27, 1947, under sponsorship of the Aero Club of Michigan.

Dodge Truck Production

(*Continued from page 27*)

point on the major operations on the final line are about as follows:

Gas Tank.
Motor and attachments, etc.
Brake bleeding.
Chassis spray.
Chassis drying ovens.
Wheel and tire chutes—assembly to chassis.
Steering gear and wheel.
Radiator and fender drop.
Body drop.
Gas and Water.
Chassis inspection—OK lines.
Touch up after inspection approval.
Roll test and light focusing boards.
Final inspection OK.

In the new building addition the sheet metal department is a beehive of activity since it produces bodies and sheet metal parts not only for this plant but for shipment to the Los Angeles assembly plant as well. In highspotting some of the operations we can start with the fender line. Fenders in the white, as purchased from the outside, first have the wire edge rolled in, then proceed to the welding line where various small attachments are welded on by means of portable spot-welding guns. Then they go to the bumping and polishing line in preparation for the paint shop.

Cabs are produced in a small, self-contained section. The underbody assembly is made up by welding in an automatic Hydromatic spot welding machine. Cab front sections are made by welding in framing jigs, using portable Progressive spot welding guns. Cab back sections are prepared in steel framing jigs by spot and arc welding. Then the entire cab assembly is integrated in steel bucks, using spot and arc welders, and transferred to the finishing line. Similarly panel bodies are assembled in stages—first by assembling side panels on steel framing jigs, then making up the entire unit by welding in a panel back.

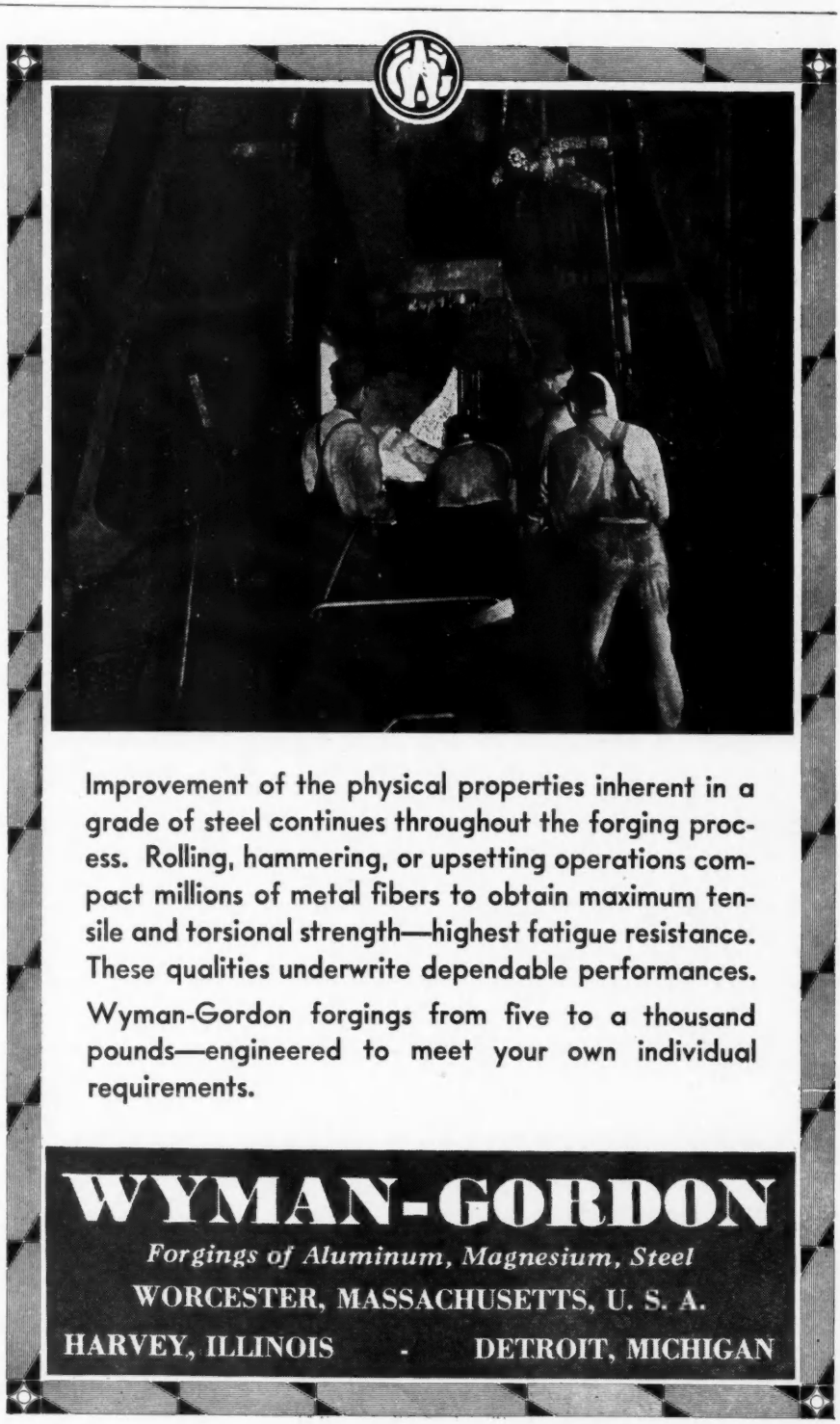
Cab and panel bodies then proceed on long finishing lines where the operators do the final welding, tinning and soldering, polishing, hanging of doors, spot welding of roof moldings on panel jobs, etc. Following inspection and touch-up operations the bodies move on the elevator to the paint shop overhead. All bodies and sheet metal are Bonderized to provide an excellent metal surface resistant to corrosion and receptive to paint.

In connection with paint spraying of sheet metal and chassis assemblies, all spray booths are of modern water back or Hydro-Spray type, provided with a powerful air blast to force all overspray and fumes onto the water curtain. This arrangement keeps the atmosphere about the operator clean and free from paint or fumes, thus contributing greatly to his comfort. In fact, none of the operators is required or find it necessary to use the conventional respirators or face masks.

The foregoing has given the reader a brief highspotting of some of the major activities in this vast plant. You can now visualize the two major final assembly lines, moving at a smooth predetermined tempo while each of the stations on the lines is supplied at the proper time with the components specified for each individual vehicle. That this is done so effectively and so smoothly is the product of a carefully studied scheme of scheduling which we shall describe in some detail.

Scheduling is by cooperative action of central management, and the sales and production departments, the central management and sales department being responsible for the advance planning which enables the manufacturing department to adjust production schedules some months ahead. Such advance planning permits the purchasing and planning department to schedule the

(*Turn to next page, please*)


Improvement of the physical properties inherent in a grade of steel continues throughout the forging process. Rolling, hammering, or upsetting operations compact millions of metal fibers to obtain maximum tensile and torsional strength—highest fatigue resistance. These qualities underwrite dependable performances.
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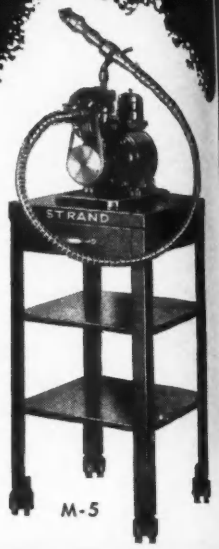

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flow of parts and raw materials from outside vendors. Assembly lines under normal conditions are scheduled a number of days in advance, tentatively, and are given firm schedules daily. Owing to the lead time on body production, bodies usually are scheduled three days in advance of the final lines.

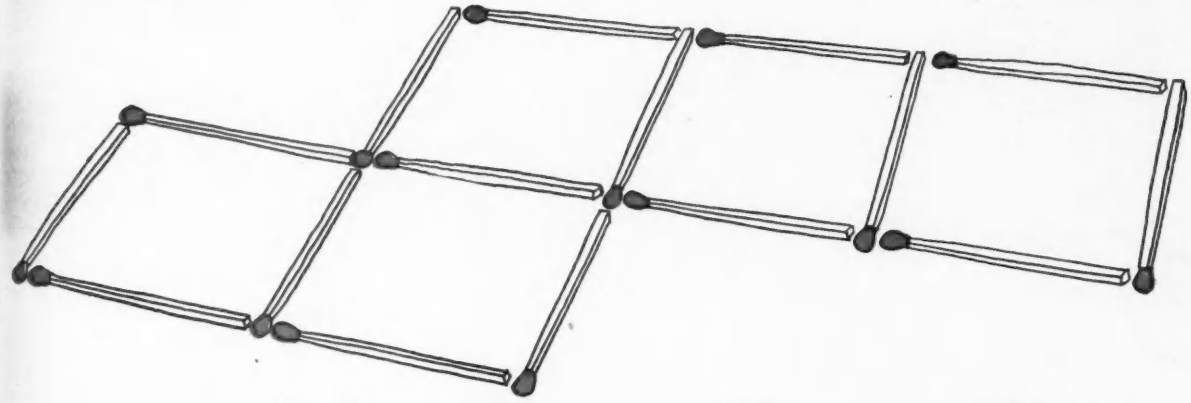
Heart of the system is the broadcasting department, so-called, which is located on the main floor and operates the teletype machines responsible for broadcasting firm schedules to the plant. Punched cards produced from information on the sales order give the detailed specifications for each individual job. The card is designed to provide complete information as to chassis model, wheelbase, color, tire sizes, axle type and ratio and, in addition, extra and special items of equipment, such as—auxiliary springs, governor, oil filter, brake boosters, shock absorbers, bumpers, etc.

Nine copies of this card are attached to a given body as it leaves the paint shop. When the body is in the bank, one of the copies goes to the broadcast department to start the wheel turning on the scheduling of the final lines. Since there are two final lines, they have two teletype machines here, one for each line. The information on the punch card is transferred to another type of card on the teletype machine where the specifications appear in a code understandable by the various receiving stations. The message is broadcast to the following six major stations which control the major aspects of the operation: Frame assembly, axle assembly, wheel and tire assembly, body bank, paint shop, engine assembly.

Normally this type of control schedules the final lines each day in accordance with the availability of completed bodies. By this means there is a flow of chassis in proper sequence, followed by other components unique to an individual vehicle, in accordance with the broadcast schedule. However, there is sufficient flexibility in this system to permit of changes during the course of a given day, in the event of some shortage of parts which might leave a given job incomplete.

Douglas Transport Sets Load Record

According to Headquarters of the Air Materiel Command, Wright Field, Ohio, for whom the Douglas Aircraft Co. conducted load-lifting tests at Muroc Army Air Field, Calif., a gross load of 172,000 lb, greatest weight ever to leave the earth under power, has been lifted by the Douglas C-74 Globemaster, army super-transport plane designed to circle the globe with only two stops.



No 4. The Great Match Trick...

The problem: Shift the positions of two matches, and reduce the number of squares from five to four — all of equal sizes.

Strong minds have gone to pieces over this little proposition, yet even the village idiot *should* be able to solve it easily.

For that's the way it is with many of the toughest problems. They're idiotically simple — once you know the solution.

Metal turning costs are a problem. The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

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Manufacturing in Sweden

(*Continued from page* 23)

sembly plant was shifted over to the manufacture of parts for automobiles. This business has been extended to such a degree as to embrace practically all parts necessary for an automobile. Out of this experience grew the idea to manufacture an entire car.

For a year and a half a number of engineers have been working on the blueprints for this car and a model has recently been demonstrated. Like the Volvo PV 444 it is a small car largely designed to replace German brands such as DKW and Opel.

The idea is that this car shall be manufactured according to the same principles as Volvo's automobiles. The company is now contacting potential sub-contractors and if the offers obtained appear attractive the manufacture of this new Swedish car will be started late in the present year.

The sales of Swedish automobiles have not been confined to the domestic market. They have been produced efficiently enough to permit exports to countries all over the world. Few automotive companies in the world seem to export such a great percentage of their output as Volvo which normally sold 40 percent of its trucks and busses abroad. In 1939 Swedish exports of automotive products amounted to about $4 million, with the Scandinavian and the Mediterranian countries being the principal markets.

The experience of the Volvo Co. indicated that the introduction of a new automobile in a foreign market is a slow process. It generally takes a great many years before it has been proved that the newcomer is worth its money. In Finland, for instance, Volvo started its activity as early as 1929 but in 1935 the sales volume was still $50,000 only. However, after 1935 sales advanced rapidly and in 1939 sales were up to $200,000 dollars. The best sales argument has proved to be a referencee to Swedish steel which has the highest reputation all over the world.

Swedish automobiles have, as a general rule, been marketed through local agents. This type of organization has proved most appropriate as, on the one hand, the sales volume does not justify the setting up of subsidiary companies and, on the other hand a local organization does not arouse as much nationalistic sentiments as a foreign company. To quote the president of the Volvo Co., cars move easier across the border than does an organization. In two countries only — Finland and Argentina — Volvo has set up subsidiary companies of its own, but this for the reason that no suitable agents were obtainable in these countries.

Today the Swedish automotive industry is faced with a huge demand both in the domestic market and from abroad. The policy of the Swedish companies is to treat domestic and foreign buyers equally. Thus a certain number of automobiles are set aside for export corresponding to the prewar share of the foreign markets in total production.

There is, quite naturally, a certain demand also from new customers. One example might illustrate that. After the occupation of Norway the Germans captured a Scania-Vabis bus. It was sent to Holland, where it was used to carry workers from and to a factory. It was the only bus of this brand in that country. Having run for four years without requiring any spare parts the Dutch decided, after the liberation of their country, to have more busses of this brand. They ordered 18 and got them. They sent a new order for 500, which, however, it was impossible to fill under present circumstances.

Prior to the war the Swedish automotive companies slowly expanded their exports into new markets, adding two or three countries per year to their foreign sales area. They will now concentrate on supplying their former customers and abstrain from develop-

(*Turn to page* 92; *please*)

Oil-bath air cleaners
VORTOX FIRSTS
The FIRST Oil-Bath Air Cleaner for internal combustion engines was designed and patented by the Vortox Company in 1920.
The latest model illustrated above incorporates many refinements and improvements, but the first models did embody so many of the fundamentals of the ultimate in Oil-Bath Air Cleaners that many of them are still in use. We still receive and fill replacement orders for these first cleaners.
All through the years Vortox leadership has been strengthened and maintained with a series of Vortox "firsts".
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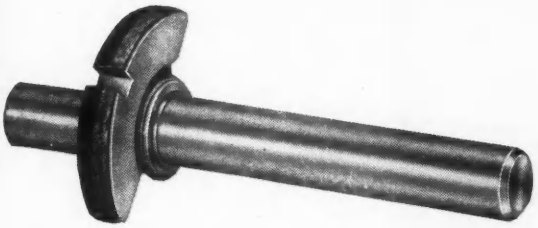
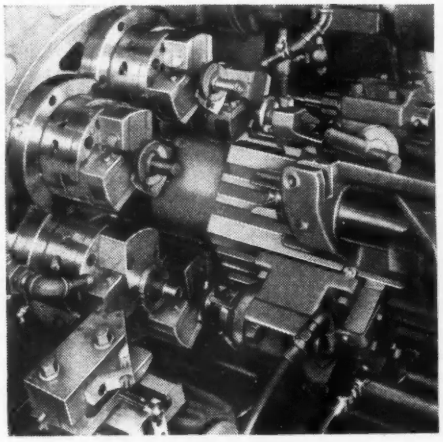
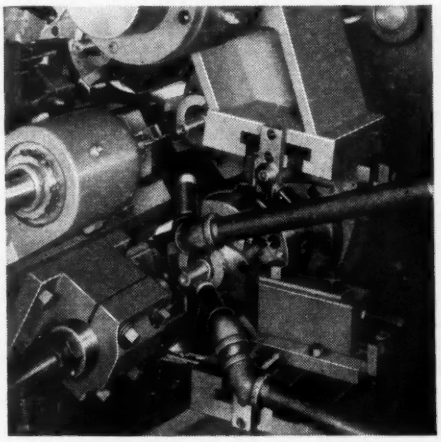
. . . A CASE OF MATCHED PRODUCTION



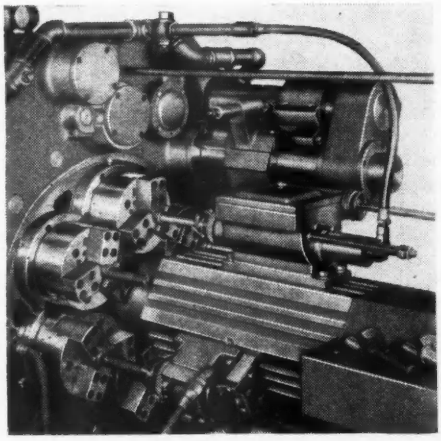
The production of the forged steel crankshaft illustrated above requires two operations. The function of the first is to finish the short eccentric end, while the second machines the long end. Model 675 New Britain Automatic Six Spindle Chucking Machines were selected for this job and to achieve top efficiency our engineers were able to match the production of both, at 133 pieces per hour. The counterweight is faced on both sides during the first operation, enabling the second machine to operate at higher spindle speeds for the machining of the longer end.



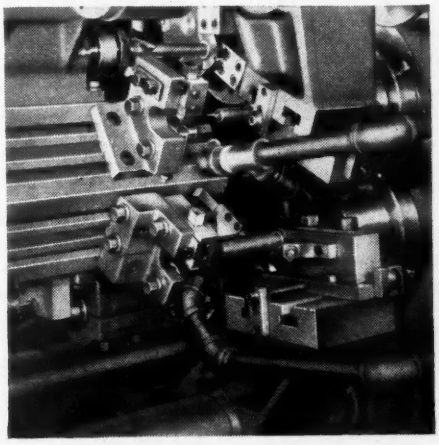
● Front view first operation . . . Entirely open end construction provides accessibility for simplified chucking, cutting tool and attachment setup.



● Rear view first operation . . . Wide open end construction provides extra large chip space . . . accessibility from three sides and from above that permits excellent visibility and easy tool adjustment.



● Front view second operation . . . Note accessibility to tools through entirely open end construction.



● Rear view second operation . . . Note relationship of cross arms to tool slide permitting more efficient tool layout and high production.

New Britain builds a complete line of Multiple Spindle Automatic Chucking Machines . . . four, six and eight spindles up to 12" capacity . . . Also a complete line of Multiple Spindle Automatic Screw Machines to 2¼" capacity.

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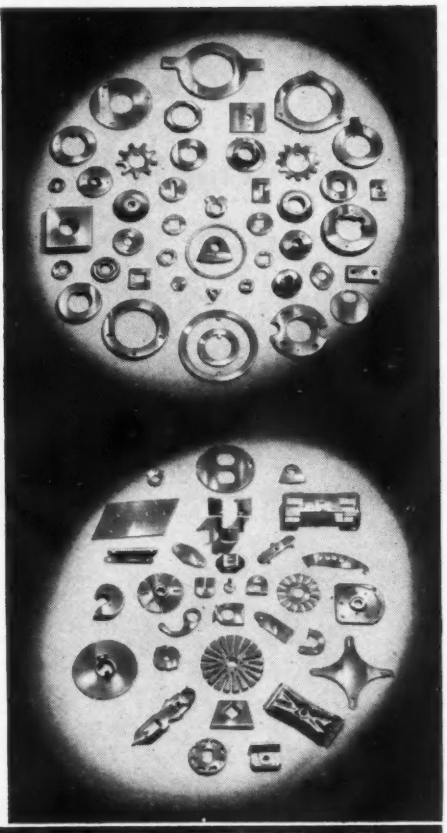

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ing new markets. The newly designed passenger cars are mainly intended for the domestic market although some shipments will be made to the other Scandinavian countries. So far automobiles have been delivered without tires to foreign countries.

Prior to the war the annual sales of automobiles in Sweden amounted to 40,000 to 50,000. In the years to come domestic production of automobiles will be much larger but a substantial portion of the total output will be exported. Furthermore, automobiles are the most important of the few items on which there is a considerable pent-up demand. As far as American automobiles are concerned they will profit from the diminished foreign competition on the Swedish market.

A recent investigation revealed that on January 1, 1946, the German Opel was most prevalent among Swedish passenger cars, accounting for 20 per cent of the total. Chevrolet and Ford ranked next with 16 per cent each. Among the busses the domestic Volvo and Scania-Vabis dominated with 43 and 34 per cent, respectively. Among trucks Volvo was also the leading brand with 42 per cent of the total, followed by Chevrolet and Ford with 21 and 13 per cent, respectively. In the field of passenger cars which still will be supplied chiefly from foreign countries American brands are likely to increase their share in total sales.

Since V-J day Swedish motoring has undoubtedly moved rapidly toward restoration of normal conditions. The number of registered automobiles has increased by 23 percent during the last quarter of 1945 and during the present year this move has continued. Furthermore, the transition from producer-gas to gaoline has made great headway. On January 1, the relation between producer-gas and gasoline in passenger cars was 50-50 as against 87 per cent producer-gas on October 1, 1945. At the present time practically all cars are driven by gasoline, whereas a number of trucks still are using producer-gas.

Month after month thousands of automobiles are again put into traffic. However, it can be taken for granted that a great portion of the 275,000 automobiles registered in 1939 never again will appear on the roads. It is believed that the entire stock of 275,000 automobiles will have to be replaced during th course of five years. In addition to the replacement demand there is a great demand for new automobiles.

Among American manufacturers General Motors shipped 500 trucks before the strike but since then only a few samples of passenger cars have been delivered. The largest shipments this year are expected from Ford. During the first three and a half months of this year that company shipped about 400 automobiles. By August a monthly rate of 400 is contemplated and a further increase up to 1000 per month by the end of the year, divided equally between trucks and cars.

With a well-organized economy and with adequate dollar assets Sweden will undoubtedly prove to be an important market for the American automobile industry. The Swedish demand of American brands is estimated at 50,000 per year which is more than this country will be able to supply during several years to come.

Dutch Firm to Build All-Aluminum Buses

The Warkspoor, a Dutch construction company, has completed plans to begin the production of all-aluminum motor buses sometime next year, according to Netherlands government officials.

Tied in with the program is the immediate resumption of operations by Dutch aluminum rolling mills at Utrecht.

During the initial period of production, the Dutch firm plans to import spare parts from the White Motor Co., Cleveland, it was said. After 1948, it is anticipated that Dutch factories will be able to supply the parts.

Sales of the coaches will be handled by a newly organized firm, the White Coach of Holland. It is also intended to produce buses for export to other western European countries.

Powder Metallurgy Laboratory Opened

Earl S. Patch, formerly sales manager for Moraine Products Division of General Motors Corp., and C. Robert Talmadge, who was associated with Patch at Moraine, have announced the opening of an office and laboratory at Stamford, Conn., to serve industry in the field of power metallurgy. Their activities will cover sales, research, management, applications, production, and equipment.

Testing Aircraft Structure

(*Continued from page* 19)

main air supply being used for changing specimens.

Although air loading has found somewhat extensive use in the Convair Engineering Test Laboratories, it is considered a supplement rather than a substitute for hydraulics. Not only is it limited by the magnitude of load required, but, owing to the compressibility of air, load is not relieved on specimen failure, resulting in excessive damage to fabricated parts if used for destruction tests. However, within the above limits, air is far superior in that no additional pump is required, it is faster than hydraulics, and above all, it is cleaner, thereby eliminating the chance of spilling hydraulic oil inside a new airplane.